

COUNTY BRIDGE AND ROAD CAPITAL IMPROVEMENT PLANNING AND FINANCING MANUAL

Prepared for

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Local Government Assistance Division
Treasure State Endowment Program*

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PREFACE

This Manual -- its purpose and format

The Montana Department of Commerce (DOC) commissioned the preparation of this manual to assist counties in resolving difficulties associated with raising adequate funding for bridge repairs and replacement as well as for planning and financing of county road improvements. While the DOC has developed a number of publications providing technical assistance in capital improvements planning and financing, no publication, until now, has focused on bridges and roads. The Montana Treasure State Endowment Program (TSEP), which is administered by the DOC is a State-funded public facilities program designed to assist communities in financing drinking water systems, wastewater treatment facilities, sanitary or storm sewer systems, solid waste disposal and separation systems, and bridges. The DOC is interested in providing information which will assist counties in preparing bridge proposals for the TSEP program, as well as in developing comprehensive strategies for the planning and financing of bridge and road infrastructure in general.

This manual has been prepared by Community Development Services of Montana in association with WGM Group and Muth Consulting Engineers and with the assistance and support from DOC and the Montana Association of Counties (MACo). It provides a straightforward, "hands-on" approach for counties to take in the planning and financing of bridges and roads. The manual features a series of specific exercises which can be used for local planning purposes and which are readily applicable to a number of funding program proposal requirements. It also provides specific information on funding programs, available technical assistance, opportunities for cooperative solutions, and condition assessment methodologies. Finally, while the scope of this manual is generally limited to bridges and roads (with an emphasis on bridges), the information presented should be viewed within the larger, more comprehensive capital improvements planning process that a county undertakes.

This manual provides the framework for capital improvements planning for bridges and roads. The manual identifies methodologies to evaluate need, set priorities, evaluate alternatives, develop a plan for building and maintaining capital facilities and ways to implement the plan. The Montana Department of Commerce has additional information on the capital improvement planning process including *A Handbook: Capital Facilities Scheduling and Financing* (May, 1995) and *The Mini Capital Improvements Plan for Small Towns -- Third Edition* (March, 1996).

State Wide County Survey

As a first step in the preparation of the manual, the consultants undertook a survey of Montana's 56 counties to learn how they were currently evaluating the condition of their bridges and roads and how they were financing repairs, rehabilitation and reconstruction projects. The consultants were successful in reaching 80 percent of the targeted group, or 44 counties. Road personnel and county commissioners (who in some cases also serve as road supervisors) were interviewed by phone during July of 1996.

Test County Component

The manual has been prepared using a demonstration county, to enable us to test the methodologies presented. We worked closely with county commissioners, road personnel, and members of the public in Teton County in identifying bridge and road needs, in setting priorities and identifying likely funding scenarios. A description of activities undertaken in the test county can be found in Appendix B. The results of the test county program have been broadened to make them suitable to counties of varying size and condition.

Acknowledgement

The authors would like to acknowledge the Montana Department of Transportation (MDT) for their assistance in the preparation of this manual. Users of the manual should contact MDT regarding on-system transportation issues such as funding and needs assessment.

The following is a list of MDT telephone numbers that may be of assistance to you (406 area code):

Pavement Management – Jon Watson, P. E. - 444-7260
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Statewide Transportation Improvement Program (STIP) - Jeff Ebert, P.E. - 444-7639
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Appendix C – Funding Sources, has been revised as of January 2001. Many of the revisions are based on changes to the Department of Transportation's Funding Programs.

County Bridge and Road Capital Improvement Planning and Financing Manual

Table of Contents

Topic	Page No.
Chapter 1. Introduction	1-1
• Montana's Transportation Infrastructure	1-1
• Bridge and Road Financing Issues	1-3
• Introduction to the Capital Improvements Planning Process	1-4
• Steps Included in Capital Improvements Planning	1-5
• Roll and Responsibilities ~ In Capital Improvements Planning	1-7
Chapter 2. Assessing Need and Setting Priorities	2-1
• Introduction	2-1
• Defining Need	2-2
• Measuring Need	2-2
• Setting Initial Priorities	2-6
Chapter 3. Evaluating Alternatives	3-1
• Introduction	3-1
• Evaluating Alternatives	3-2
• Identifying Preferred Alternatives	3-3
• Re-Visiting Priorities ~ New Considerations	3-3
Chapter 4. Evaluating Funding Options	4-1
• Introduction	4-1
• Evaluation of Funding Options	4-1
• Project Costs	4-3
• Availability of Funding	4-3
• Keeping Track of Funding Sources	4-4
Chapter 5. Adopting and Implementing the Capital Improvements Plan	5-1
• Introduction ~ Putting the Plan Together	5-1
• Adopting the Plan	5-4
• Implementing the Plan	5-4
• Coordination with other Agencies and Partners	5-9
• Other Issues	5-11

Appendix

Appendix A. Bridge and Road Manual Project Survey Component	A-1
• Introduction	A-1
• Assessments and Priorities	A-2
• Funding	A-2
• Critical Concerns	A-4
• Other Issues	A-5
Appendix B. Test County Component Description	B-1
• Introduction	B-1
• Test County Approach	B-1
Appendix C. Funding Sources	C-1
• Introduction	C-1
• Local Financing Tools	C-1
• Montana Department of Transportation (MDT) Funding Sources	C-7
• Other State and Federal Funding Sources	C-14
Appendix D. Road System Planning	D-1
• Introduction	D-1
• Preparing a Plan	D-2
• Labor and Equipment Considerations	D-16
• Bibliography	D-19
• Blank Forms for Planning	D-21
• Special Addendum on Road CIP Planning	Addendum D-1
• Introduction	Addendum D-1
• How to Perform a Road Condition Analysis	Addendum D-1
Appendix E. Bridge System Planning	E-1
• Bridges in Montana	E-1
• The County's Role	E-2
• Preparing a Bridge Plan	E-2
• Sample Forms	E-21

List of Tables and Figures

Chapter 1	
Figure 1-1 The Capital Improvements Planning Process	1-7
Chapter 2	
Table 2-1 Suggested Inventory Form for Bridges	2-3
Table 2-2 Suggested Inventory Form for Roads	2-3
Chapter 4	
Table 4-1 Analysis of Local Financial Capacity	4-4
Chapter 5	
Table 5-1 Capital Improvement Plan Matrix	5-2
Appendix C	
Table C-1 Local Financing Tools	C-22
Table C-2 Montana Department of Transportation Programs	C-23
Table C-3 Other State and Federal Funding Sources	C-24
Appendix D	
Figure D-1 Development Steps for the Plan	D-3
Figure D-2 Road System Classification	D-5
Figure D-3 Typical Road Section	D-7
Table D-1 Engineering Characteristics of Soils	D-9
Table D-2 A Sampling of Alternative Solutions In Pavement Maintenance and Rehabilitation	D-14
Appendix E	
Figure E-1 Simple Beam Bridge	E-5

CHAPTER 1. INTRODUCTION

One out of three bridges in America today is rated structurally deficient or functionally obsolete and needs major improvements ranging from deck replacements to complete reconstruction. More than a fourth of all bridges nationwide are more than 50 years of age, which is the average life span of a bridge. The cost to eliminate the backlog of existing bridge deficiencies nationwide is approximately \$78 billion. Today, some 234,500 miles of U.S. roads are rated poor or mediocre. In addition more than 70 percent of peak hour travel on urban interstates occurs under congested or severely congested conditions. With road use expected to increase by nearly two-thirds over the next twenty years, additional strains will be added to an already overburdened system. The cost to eliminate the existing backlog of highway deficiencies is approximately \$212 billion. (Source: Federal Highway Administration -- Courtesy of the American Public Works Association)

*There are 70,000 miles of streets and roads in Montana. Government agencies, other than the state of Montana, are responsible for maintaining 83 percent or about 58,000 miles of the total roads statewide. The cost of bringing all of these roads up to current standards is estimated to be in the **billions** of dollars. Obtaining the necessary funds to meet this incredible responsibility is increasingly more difficult. (Information Handbook for the 55th Legislature, Montana Department of Transportation)*

According to an article published in the Helena Independent Record on November 23, 1997, one out of every five bridges in Montana is in need of repair or replacement.... State Department of Transportation figures show the number of dilapidated or obsolete bridges has increased from 877 to 935 in the past three years....the state gets an average of \$11 million a year from the federal government for bridges. That is enough to fix or replace an average of only 17 bridges. Other money for bridges comes from counties, which spend about \$10.5 million a year on the structures that dot local roads. Montana has 4,433 bridges (which are inspected by the Montana Department of Transportation) with an average age of 37 years. The troublesome ones typically are 50 years old and about 60 percent are in such bad shape they need replacement. The state pegs the cost of repair or replacement of all deficient bridges at \$361 million.

I. Montana's Transportation Infrastructure

In Montana, our bridge and road infrastructure is critical to the state's economic and social health. The rural character of our state -- few people in a vast landscape -- is particularly evident when we look at our transportation infrastructure. Montana has a total of 69,580 miles of roads, of which 97 percent are outside urban areas. These rural roads provide important linkages between communities and to the national transportation system. They connect producers to their markets and to rail and air transportation.

Montana's roads and bridges are divided into two general classifications, which determine how they are funded and maintained:

- **On-System Roads and Bridges:** These include Interstate and non-Interstate National Highways, designated urban routes, primary and secondary highways. There are 12,842 miles of "on-system" roads and associated bridges of which 4,437 miles are maintained by Montana's counties.

On-system refers to eligibility to receive Federal-Aid or state funding and that for the most part, local governments have jurisdiction over secondary and urban highways.

- **Off-System Roads and Bridges:** All other roads and associated bridges are classified as off-system and account for a total of 56,738 miles both inside and outside incorporated areas. Counties are responsible for 53,692 miles of "off-system" roads.

Information regarding the condition of our transportation infrastructure is currently limited to the primary and Interstate system, the National Highway system and other on-system paved roadway and to bridges over 20 feet in length. This information is available through the Montana Department of Transportation (MDT), Pavement Management Section and the Bridge Bureau. MDT has developed computer based pavement and bridge management systems that provide for extensive condition assessments. However, for the most part, counties must rely on their own resources to evaluate the condition of off-system or un-paved roads and bridges under 20 feet long.

There are over 5,200 bridges in Montana, of which 4,433 are inspected every two years by the MDT in accordance with federal guidelines. Of those inspected, 23.5 percent have been rated "structurally deficient" or "functionally obsolete" as compared to the national average of 30 percent. The percentage is higher, however, for local off-system bridges. Of the 1,858 off-system bridges inspected, 34 percent (632) have been found to be in need of repair or replacement. The remaining bridges (under 20 feet in length) are not regularly inspected and state-wide data is not available regarding their condition.

In some cases, criteria used to establish functional obsolescence are not applicable to Montana's lower traffic volumes. Nonetheless, the need remains significant.

At the same time, road systems are experiencing increases in daily vehicle miles traveled (a vehicle mile is the equivalent of one vehicle traveling one mile). In its 1996 *Annual Report*, the MDT noted that in 1994, there were just under 25 million daily vehicle miles, an increase of 4.7 percent from the previous year. The largest increase outside of the national highway system was 11.75 percent for off-system local roads (from 5,610,959 to 6,270,063 daily vehicle miles traveled). While counties recognize the need to develop better methodologies for assessing condition and setting priorities for transportation infrastructure projects for roads and bridges under local jurisdiction, they often have limited resources available to commit to capital improvements planning. They are keenly aware that a regular maintenance program based on well documented information regarding condition would reduce the number of costly reconstruction

projects. In general, Montana's counties are facing critical transportation deficiencies as we move into the 21st Century.

II. Bridge and Road Financing Issues

Funds for bridges and roads in Montana come from three major sources. These include Federal Highway Administration monies; state funds derived from fuel taxes and other fees; and local allocations of funding from taxes, fees and special payments from other governmental entities. In addition to ad valorem taxes (taxes which are based on a percentage of property value expressed in mills) and other local assessments, all counties receive a portion of the state levied fuel tax. Their share of the fuel tax is based on their population, road miles and geographic area. In addition, those counties with publicly owned land receive payment in lieu of taxes from various land management agencies. Some receive a percentage of timber receipts realized in their county. Counties also receive a portion of state-wide taxes levied on certain resources such as oil.

Counties can also apply for funding for their bridges and roads through a number of state and federal financing programs. The Save Our Secondaries (SOS) Program which currently funds secondary roads, pavement preservation and off-system bridges, the on and off-system bridge program, and the secondary construction program are all administered by the MDT. Just a few of the other programs include: the U.S. Forest Service Wood in Transportation program (formerly the Timber Bridge grant program), the Federal Emergency Management Program, the Montana Interap loan program (through the Board of Investments) and the Treasure State Endowment Program (TSEP) administered by the Department of Commerce. These and other programs are described more fully in Appendix C of this manual.

In some cases, county governments enter into cooperative agreements with state and federal agencies for inspections, maintenance and construction. In Teton County, for example, the Department of Defense provides funding for removal of snow on roads associated with the U.S. Air Force and missile sites. The U. S. Bureau of Land Management has provided gravel to county road departments at a number of locations. The Montana Department of Fish, Wildlife and Parks (FWP) often works with counties to provide funding for bridges and roads to provide access to fishing and wildlife management areas. Counties can create special districts through which property owners share in the cost of maintenance and construction. Typically this approach has been used for roads rather than bridges, however. A few counties have considered the use of development impact fees for road construction. Counties have the authority to levy general obligation bonds, and revenue bonds to finance bridges and roads. Montana statute also authorizes counties to create road and bridge depreciation reserve funds under 7-14-2506, MCA.

However, available funding is not keeping pace with maintenance and construction requirements. With a small population and limited financial resources, Montanans have always had to make due with less. At the local level, we have experienced substantial

changes in our tax base. Property taxes derived from agricultural land have steadily declined from 32.659 percent in 1929 to only 8 percent in 1994 (information derived from the Montana Department of Revenue, various biennial reports). During the same period, residential and commercial real property increased from 25.899 percent to 46.2 percent of the tax base. In the mid-1980's, many Montanans feared that the cost of maintaining government services would increasingly fall to residential property owners. As a result, in 1986, Montana passed a voter-generated initiative to freeze property taxes at the 1986 level. Initiative 105, which contains no adjustment for inflation, has had far reaching affects on the ability of communities to fund the rising cost of public infrastructure and to manage the affairs of local governments. The majority of Montana counties are facing continued deterioration of roads and bridges. Often, county road crews are operating with half the staff that they had in 1986. Many county budgets could easily be doubled in order to meet the current need for bridge and road maintenance, repair and construction.

In summary, needs are greater than resources for all revenue sources related to capital improvements and local governments will increasingly be required to explore approaches (within the limitations of Initiative 105) which enable the beneficiaries to share in the costs of the improvements.

III. Introduction to the Capital Improvement Planning Process

Capital improvement planning can be viewed as one of the most critical processes that a local government undertakes. Planning for the financing of maintenance, repairs and construction of our public infrastructure is extremely important in light of limited financial resources that are available to meet ever increasing demand. This manual is directed towards capital improvements planning for county bridges and roads. However, transportation infrastructure concerns are a component of the larger more comprehensive capital improvement planning process that a county undertakes. Priorities related to bridge and road infrastructure needs must also be balanced against other county capital requirements.

"Capital improvements planning" is defined as a process by which local governments identify capital (public facility) needs, establish project priorities and set forth a program for the scheduling and funding of construction or repair projects. Capital improvements planning serves a number of purposes:

- It provides local governing bodies with a defensible basis upon which to make decisions regarding the allocation of human and financial resources.
- It provides a mechanism to schedule capital projects with regard to financial limitations and projected demographic and economic change.
- It assists potential outside funding sources in evaluating local government

funding applications in light of overall needs and available resources.

The capital improvements planning process can be universally applied in addressing the variety of public facilities concerns, including transportation, water and wastewater treatment, public safety, law enforcement, public libraries, hospitals, and recreational facilities and equipment. Ultimately, all capital needs should be viewed in the larger context of county requirements and available resources. For example, school districts, rather than county governments, may have the responsibility of developing capital improvement plans for their buildings and facilities. However, if tax payers are already supporting a bond debt for a new high school, they may be resistant to financing a general obligation bond to fund a new county jail.

A. Steps Included in Capital Improvements Planning

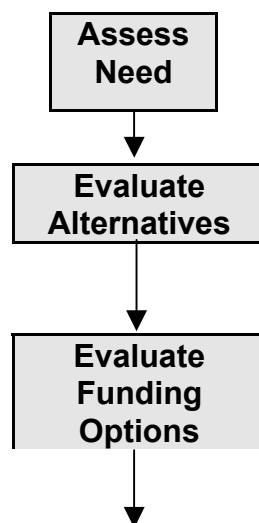
Capital improvement planning typically follows a series of steps. Each has a strong public participation component.

- **Assessing Need.** "Need" can be evaluated using a number of different methodologies including site inventories and surveys, engineering studies of infrastructure condition, census data analyses and observations of population and demographic trends. Sometimes needs are defined through the regulatory process. For example, functional obsolescence for bridges is measured according to standards set by the Federal Highway Administration. Each approach to assessing needs requires public review and input whereby residents can provide information related to their experiences and concerns.
- **Setting Priorities.** The setting of priorities occurs a number of times during the capital improvement planning process. Once the needs assessment is complete, residents and local government staff work together to identify those needs that should receive the greatest attention first. However, as potential solutions are defined, priorities may be changed to reflect available funding, regulatory and other issues.
- **Identifying Projects/Evaluating Alternative Solutions.** Once the level and character of the need has been defined and priorities listed, the next step in the planning process is to identify possible solutions to address specific needs. Often there may be a series of potential strategies that can be pursued. Each alternative should be evaluated for its cost in the long and short term, public acceptance, maintenance requirements and other associated impacts. Once sources of funding are identified (in the next step), it may be necessary to re-evaluate alternatives to fit available resources, funding cycles and other regulatory concerns. Often this step requires the development of preliminary designs and project costs to aid in the evaluation of alternatives.
- **Evaluating Funding Options.** This step requires a comprehensive analysis of community capacity to pay for the desired improvements as well as outside funding which might be directed to specific projects. This involves identifying the various specific legal and administrative requirements that must be fulfilled,

funding cycles and program criteria. This step enables a county to accurately portray its financial condition to potential funding sources and to the public.

- **Scheduling Activities.** Limited funding, protracted grant review periods, and the necessity for preliminary planning and engineering work typically require that projects be carefully scheduled. Often projects are designed in phases to match funding capacity and availability. Once a particular project has been identified, it may take months or years before it can be completed. Scheduling enables counties to anticipate projects over a period of years and to measure progress.
- **Adopting the Capital Improvement Plan (CIP).** The CIP, containing the descriptions of need, the evaluation of alternatives, the preferred alternatives, cost estimates and scheduling is typically adopted by the local governing body by resolution or ordinance after a public hearing. The governing body should provide for a regular periodic review and update of the CIP. Preferably, this should be done annually in conjunction with the local government's budgeting process.
- **Implementing the Plan (Financing and Constructing Specific Projects).** The formal adoption of the CIP provides the mechanism for county personnel to implement the road, bridge and other projects identified. The information collected in the preparation of the CIP can also be used to complete various funding applications required by state and federal agencies that administer capital grants. This is particularly true for the information related to need, to community financial capacity and to the evaluation of alternative solutions. A CIP, which reflects thoughtful analysis and extensive public participation will serve a county well over time. Once a CIP is in place, updates can be made easily within an existing format. It can also provide easily accessible, concise information to elected officials who change over time but are obligated to follow a previously adopted course of action.

Figure 1-1 The Capital Improvements Planning Process



Adopt and Implement the CIP
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B. Roles and Responsibilities ~ In Capital Improvements Planning

The capital improvement planning process may be accomplished in a variety of ways. The county commission may choose to undertake the effort themselves, with outside assistance or some combination of both. For example, in those counties that have larger staffs, CIP planning tasks are frequently incorporated in a particular position (county planner, engineer, administrator, etc.). However, in counties with limited staff, the commission might hire a consultant to help the county identify bridge and road concerns and to set priorities. Technical issues are often addressed by a professional consultant, knowledgeable in a specific area of expertise. For example, civil engineering services are often required to accurately determine both the condition of a bridge and the nature of any required repair or construction.

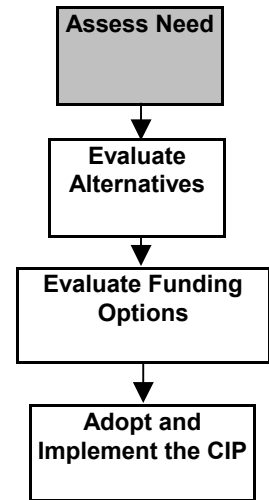
- **Initiating the Process.** The county commission may initiate the capital improvement planning process any time. Often, the need for a CIP is triggered by a program requirement, e.g. eligibility for funding from a state or federal agency. However, the county should consider establishing a capital improvements planning process as part of its overall effort to adequately plan for public facility needs over a period of years. The CIP is an important tool in helping commissioners and the county road supervisor allocate financial and human resources. The plan can be used as a basis for setting county budgets in conjunction with other planning documents such as the county wide master plan. The decision to prepare a capital improvement plan should be noted in the meeting minutes of commission. The person or persons responsible for defining the steps to be taken and overseeing the process should also be identified.
- **Allocation of Resources for Planning.** The capital improvements planning process will require the commitment of a combination of human and financial resources. Funding sources should be identified to cover the cost of outside consultants as appropriate. If substantial staff time will be required, then arrangements should be made with respect to personnel scheduling. Funding allocations should also include adequate financial support for public hearings, meeting notices, solicitations for professional services, mailings, map production, and printing.

- **Assigning Tasks.** Following the initiation of the planning process, the commissioners should identify the various tasks and the appropriate person or persons responsible. Throughout the process of planning bridge and road capital improvements, the commissioners, county planners and consultants should confer with the county road supervisor. In most counties, the road supervisor maintains information about the condition of roads and bridges, project priorities and related concerns (manpower, equipment, regulatory issues). When outside engineering services are needed, the county road supervisor should work with the commission to prepare solicitations for procuring the necessary services. The county road supervisor can also serve as the planning coordinator on behalf of the commission with regard to bridge and road issues.
- **Hiring Consultants.** In those cases where a county requires the services of planning and technical consultants, the commissioners should work with their staff and the county road supervisor to carefully define the scope of work, which the consultant will complete. To the greatest extent possible, the county should anticipate the kind of information they might need in completing and implementing the capital improvements plan. For example, the commissioners might review a sampling of funding applications to see the kinds of questions they might have to answer in completing funding requests. The solicitation for professional services should clearly state the type of services required (public facilitator, financial consulting, engineering, etc.). *Working with Consultants*, a publication of the Montana Department of Commerce, provides guidance on how to select and work with a consultant.
- **Public Meetings.** The county commission should provide ample opportunity for public participation in the planning process. The county may choose to hire an outside planner/facilitator to assist in making the process as meaningful and useful as possible. The public participation component of bridge and road planning is described more fully in Chapter 2.
- **Progress Reports.** The county commission should be provided with regular updates on the planning process. Reports should include copies of needs assessments, community surveys, minutes of public meetings, engineering studies and cost estimates.
- **Preparing the Plan.** Once the necessary information has been gathered, the commission must prepare the plan. Document writing may be assigned to a county staff member or an outside consultant. A specific person should be assigned the responsibility for coordinating the preparation and update of the plan. The plan should include a process for periodic updates and assign responsibility for completing updates as required.
- **Plan Adoption and Implementation.** The county commission is responsible for adoption of the plan. (See Chapter 5 of this manual for more specific information regarding plan adoption.)

- **Preparing Funding Proposals.** Chapter 5 of this plan provides information regarding the preparation of proposals to secure outside funding to implement the plan. The responsibility for completing funding applications must also be assigned. Once again, this task may be undertaken by the commissioners, county staff, an outside consultant or some combination of all three.

CHAPTER 2. ASSESSING NEED AND SETTING PRIORITIES ~ AN OVERVIEW

This chapter provides an overview to the needs assessment process. Accurately measuring and defining need is the first step in the capital improvements planning process. It provides local governing bodies with a defensible basis upon which to make decisions regarding the allocation of human and financial resources. Need can be evaluated using various methodologies including site inventories and surveys, engineering studies, census data analyses, and public meetings.



I. Introduction

The "needs assessment" provides the foundation for any capital improvement planning process. The ability to accurately describe and quantify the need for bridge and road improvements enhances a county's success in securing funding from local, state and federal sources. Ultimately, it is the extent and critical nature of the need that convinces potential funding sources and members of the public that financial and human resources must be committed to infrastructure improvements. Need can be measured in a variety of ways. Often a combination of methodologies is employed in determining and assessing the nature and extent of need. The assessment process should identify the current condition of bridges and roads and how well they are meeting existing needs (traffic, type of use, load requirements, etc.) Secondly, the current infrastructure should be evaluated in terms of how it would meet changing conditions (increases and decreases in use). Often need can be described as the gap between what is currently provided and what is actually needed in both the immediate future and long term. It is clear that a deteriorating and unsafe bridge is not meeting current or future transportation needs. However, a bridge that is currently meeting county transportation needs may not be adequate in the face of anticipated changes in technology (e.g. the size and weight of farming or logging equipment), residential growth patterns or new industrial development. We can assess the condition of the roads and bridges and prioritize where and how limited funds should be allocated.

This chapter provides an overview to the needs assessment process. Detailed discussions of road and bridge planning including jurisdictional issues, methodologies employed in assessing condition and suggested corrective actions can be found in Appendices D and E.

II. Defining Need

There are a number of specific methodologies that can be employed in measuring bridge and road infrastructure needs. These methods are used to gauge need with respect to **what** is being measured. Need can be defined with respect to a number of factors:

- **Physical Characteristics:** The structural condition of a bridge or road according to specific standards as set forth by state and federal regulation.
- **Safety Considerations:** Those characteristics of a bridge or road that present a danger to users.
- **Impacts:** The specific impacts that occur as a result of a deficiency, e.g., how many people are affected when a bridge is structurally inadequate.
- **Benefits:** The benefits that would accrue as a result of an improvement to a road or bridge.
- **External Considerations:** The economic, environmental, regulatory or other factors that are changing which might require improvements to the transportation system.

III. Measuring Need

It is critical that the needs assessment process be designed as efficiently as possible, with respect to available resources. Clearly, coordination with state bridge inspection programs is helpful. County road and bridge supervisors, county planners, extension agents and regional economic development agencies can work together to assist in preparing a bridge and road needs assessment in the context of a capital improvements plan in general. The following is a list of methodologies that can be employed in measuring need. Typically, a combination of methods is often required to adequately substantiate the nature and extent of the need.

A. System Inventories

System inventories can be used to collect various data on the road and bridge systems, such as condition, type and frequency of use (residential, industrial, mail route, etc.). Inventory data should be collected in a consistent manner in order to accurately compare and evaluate information as well as to set priorities. In evaluating the road and bridge system it is also important to include traffic data collection to determine average annual traffic volumes and peak traffic volumes. Traffic data collections procedures are described in both federal and state manuals. In addition, statistically valid traffic volume information is available for on-system roadways through the Montana Department of Transportation (MDT). This data element is important because it is a component in the calculation of capacity and level of service, which are used to describe congestion and the ability of a facility to provide sufficient service given the demand.

System data should be collected on a regular schedule in a consistent format. Consistency in documentation provides a means to accurately portray changes in the

system over time. It also contributes to a more credible basis for decision making in the overall capital improvements planning process.

Table 2-1 Suggested Inventory Form for Bridges

Bridge Name	Type/Dimensions	On/Off System	State Rating or County Evaluation	Ave. Traffic	Primary Use	Age	Other Info.

Table 2-2 Suggested Inventory Form for Roads

Road Number	Type/miles	On/Off system	Condition	Ave. Traffic	Primary Use	Other Info.

B. Engineering Analyses

Engineering studies provide counties with accurate information related to bridge and road condition. Trained professionals, working with county road personnel can help identify a variety of infrastructure deficiencies and strengths that might go otherwise unnoticed. Engineering studies are often required by agencies prior to consideration of funding applications. Engineering analyses can provide information in a standard format that can be easily reviewed by agency staff and can provide a good basis for the additional engineering work that must be done as the project progresses. Appendices D and E provide step by step approaches to road and bridge planning. Information regarding jurisdictional issues, types of construction, soil type considerations and the identification of appropriate solutions is included.

C. Survey and Data Analysis

A variety of data exists, or can be generated, which can assist in establishing need. Census data can provide insights into population and settlement trends, assisting a county in projecting growth and decline, and the associated impacts on bridges and roads. Economic and market data regarding industry trends can help identify potential areas for county growth and associated transportation infrastructure needs. Surveys of existing businesses might reveal expansion plans, anticipated changes in technology and the associated transportation requirements. While individual industries would likely

come forward to request improvements to bridges and roads to accommodate their needs, it is far better for a county to anticipate growth over a period of years. This enables the orderly planning for transportation improvements based on the availability of financial resources and scheduling requirements.

D. Regulatory and Safety Considerations

In certain cases, need is determined through the regulatory process. For example, functional obsolescence for bridges is measured according to national standards. These standards may be less applicable to Montana where traffic volumes are lower. Need can also be impacted by safety standards relating to weight bearing capacity. In a state like Montana, with many natural resources, heavy equipment used for extractive industries (e.g., logging, mining and agriculture) can have a substantial impact on roads and bridges beyond frequency of use. Additional information concerning safety is provided in the appendices addressing bridges and roads. If a bridge is determined to be functionally obsolete, it must be updated to meet federal standards. State inspections follow federal guidelines for both functional obsolescence and structural deficiencies. It is these guidelines that determine the rating that is given to each bridge.

E. Soliciting Input from Users and Road Personnel

Some Montana counties have established advisory committees which work with their road and bridge departments to identify needs on a regular basis. The committees, often comprised of farmers and ranchers, school board members and other public and private sector representatives advise the county commissioners on a periodic basis regarding the condition of roads and bridges. Many counties identify needs within each of their road districts with input from county personnel and residents. Often, the road supervisor or superintendent collects data regarding bridge and road condition and presents information to the county commissioners on a regular basis. However, most counties acknowledge that they do not have a regular, systematic procedure for assessing needs, largely due to a lack of time and personnel. Often, a county must simply work to address the most pressing needs, on a reactive basis, to avert crises and to maintain public safety. Nevertheless, it is important that counties attempt to work towards establishing a regular, systematic procedure for assessing needs.

F. Public Participation

In addition to data collected through inventory and analysis, public concerns must be incorporated into the needs assessment. While public opinion alone cannot demonstrate need, it does provide a critical perspective. The members of the public are the users of county bridges and roads and they must be assured of their constant safety and access. Often, members of the public can bring specific problems to light, particularly in large, rural counties where road crews are responsible for large areas and resources are limited. County residents can also assist county staff in reviewing data and engineering studies in the context of their own experiences and needs. Public comment can be solicited through public meetings, personal contacts, information booths at county fairs and shopping centers, through questionnaires in local newspapers, or enclosed with utility bills or tax statements. Local radio stations can provide free public service announcements encouraging people to participate in the process.

The involvement of the public in the entire planning process is critical and the members of the public often take their cue from their elected officials. If the county commissioners are committed to a reasonable capital improvement planning effort, which is reflective of public input, county residents will be more willing to participate. Following are some suggestions to encourage meaningful public participation:

- At the onset, the county commissioners and their staff should set forth **what the planning process will entail**, including a proposed schedule. Information might include how many public meetings will be held, what staff and/or consultants will be involved in planning, what areas of infrastructure will be addressed (e.g. bridges and roads) and *how* public input will be incorporated into the plan.
- Attention should be given to the role of the public as **decision makers**. This is *their* plan and ultimately the responsibility for its implementation will be undertaken by *their* elected representatives. Members of the public will set priorities, assist in selecting alternatives and vote on specific financing mechanisms (if required). Often members of the public can be asked to serve on special committees to select consultants, to review interim proposals and to evaluate financing alternatives.
- Public participation can be sought in a number of ways: at public meetings, in newspaper surveys, flyers distributed through the schools, and through notices and surveys. Busy schedules often make it difficult to attend frequent meetings. Where possible, information can be distributed through existing organizations -- at parent teacher association meetings, at business and professional organizational meetings (Rotary, Elks, Kiwanis, Lions, Exchange Club, etc.) The county may wish to actively solicit comments from road users, such as school districts, or industrial users that use heavy equipment or trucks, such as sand and gravel or cement haulers.
- The use of an outside facilitator can help make public meetings productive. Facilitators use methods of soliciting input that provides opportunities for everyone to participate while preventing a few from dominating the meeting.

IV. Setting Initial Priorities

The assessment of needs provides the basis for setting priorities. Quantitative data can assist in identifying the most critical needs. Residents and local government personnel then work together to rank projects based on information collected, public input and regulatory requirements. The setting of priorities is a fluid process. As more information is collected regarding funding availability, other community projects, and scheduling limitations, priorities will change as required.

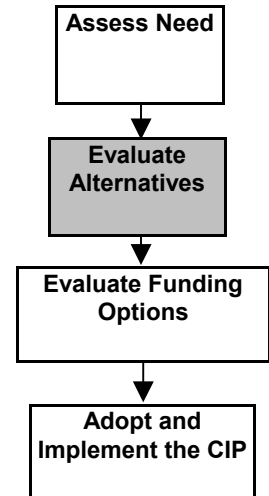
As stated above, the public should be encouraged to participate in the setting of priorities. As need is documented and measured, certain projects will emerge as the

most critical. However, it is important to provide opportunities for county residents to help rank projects in public meetings and hearings. Assistance in setting priorities and facilitation of meetings is often provided by county extension agents, regional economic development agencies and RC&Ds (Resource, Conservation and Development Organizations). RC&Ds are regional technical assistance providers, which are funded in part by the Natural Resources Conservation Service of the U. S. Department of Agriculture. While county road personnel, commissioners and professional consultants have the greatest technical knowledge about critical needs and concerns, the public can provide important insights based on their experience as users. Further, public participation in ranking projects helps residents become better informed about the activities of local government and enhances their awareness of overall county needs.

The ranking of needs at this stage of the planning process helps bring attention to the most critical concerns. As more information is gathered regarding specific improvements to be made, costs and methods of financing, priorities will change to reflect this additional information. (See Chapter 3, Evaluating Alternatives).

CHAPTER 3. EVALUATING ALTERNATIVES

Once need has been measured and defined, the next step in the process is to identify possible solutions. Typically, a detailed alternatives analysis is directed to the highest ranking priority needs only. Each potential solution should be evaluated in terms of cost -- both short and long term, public acceptance, maintenance and operational requirements, the availability of human and financial resources, budgetary requirements and other regulatory concerns. This chapter provides a methodology for reviewing alternative approaches to addressing bridge and road needs.



I. Introduction

In this chapter we present a methodology for evaluating the various alternative solutions that can be employed in addressing need. What are the possible solutions for each priority project and which one should we choose? Sometimes we will only have one solution per problem, while other times we might have multiple choices. Evaluating alternative solutions is an exhaustive process and therefore it is most typically used to evaluate only the highest ranking priorities. Further, given that the capital improvement planning process often results in a 5-year plan, it is reasonable to focus efforts on the projects that can be done within that period, given available resources. Lower ranking priorities receive less attention. However, as the capital improvement plan is periodically updated, identified needs may "move up the ladder" and given greater attention and focus.

Each identified bridge and road need can likely be addressed in a number of ways. Each alternative solution must be analyzed in regard to its anticipated success in the short and long term, associated impacts, its maintenance requirements, public acceptance and cost. The alternatives analysis is typically done for the top ranking priorities, although some attention should be given to lower ranking needs that may become more critical over time.

II. Evaluating Alternatives

For each proposed solution we need to address various issues including:
(This amount of detail would only be used in addressing the highest priority needs.)

A. What is its cost?

Cost estimates should include all anticipated elements of the project:

- preliminary engineering
- preparation of inventories of cultural/environmental resources (if necessary)
- selection of consultant
- preparation of bid documents
- solicitation of bids and contractor selection
- labor and materials
- construction oversight
- right of way concerns
- utility requirements
- environmental mitigation

B. What are the potential impacts?

These should include both negative and positive impacts:

- environmental concerns (siltation, dust, erosion, wildlife)
- cultural issues (impacts to historic or scenic values)
- recreational opportunities: access to various recreation sites
- economic development opportunities
- consistency with other community plans

C. How do we pay for this?

In many cases, road and bridge projects that have been identified by a county have been included in transportation planning documents prepared by MDT. Identified projects are implemented as resources become available. However, off-system roads and bridges under 20 feet are not included in the state planning process. Counties must finance those projects that are not typically funded through the state as well as those for which long waits are anticipated within the state program.

- county options: mill levies, rural improvement districts, bond issues
- state options (where is it on the funding list of MDT projects?)
- special funding sources: TSEP, EDA, Rural Development, etc.

D. Are there opportunities for cooperative efforts?

- Can engineering services, construction or maintenance be shared by other state or federal agencies?
- Can we work with other organizations such as a property owners association to help finance the project over the long run?

E. What are the fiscal impacts?

- What is the burden to the property tax payer?
- Does this project affect the county's bonding capacity?

F. What are the maintenance requirements?

- What specific maintenance will the improvements require?
- What are the expected annual maintenance costs?
- Do we have the capacity to perform this maintenance?

G. Other questions

- Can the project be phased?
- How long will the improvement last (what is its expected life)?
- Do we want to wait until the state undertakes this project in the normal course of events or do we want to expedite the process?

III. Identifying Preferred Alternatives

Once alternative solutions have been reviewed, county staff and members of the public work together to select the preferred alternative. Selection should occur only after each alternative has been analyzed carefully. Preferred alternatives are likely to change based on funding availability and other county priorities.

IV. Re-Visiting Priorities ~ New Considerations

In Chapter 2 we discussed the initial setting of priorities with regard to need, measured in a variety of ways. Once potential solutions have been identified to address each need, projects may have to be re-ranked with respect to other considerations. The analysis of alternative solutions brings many specific issues to light, which may affect its ranking and consideration by the governing body and members of the public. As with the initial ranking process, public participation in the re-evaluation of priorities is critical. The following issues may be used as criteria in this second look at priorities.

A. Financial Considerations

- Is the cost of the project appropriate and reasonable when measured against the benefit derived?
- Has information regarding the entire cost of the project been provided, including administrative costs, preliminary engineering costs, project design and oversight, the solicitation of bids, and all phases of construction?
- Are the costs associated with securing project financing included? These might include the preparation of proposals for grants or loans, meeting the legal requirements associated with the issuance of a bond, holding an election, or forming a special district.
- What are the costs associated with ongoing operations and maintenance (O&M)? The cost of various alternative solutions should be measured over time. Often, the long term costs for O & M of a particular improvement will exceed the initial cost of construction. Therefore, those solutions that offer lower O & M costs over time may be more attractive, even if they are more expensive initially.
- What are the impacts to the local government financial position? For example, will the proposed funding strategy require a reduction in another government

service in order to meet the requirements of Initiative 105? Does the county have sufficient legal debt capacity to issue bonds?

- What funding options exist for this project? (See Chapter 4.)

B. Public Acceptance

- Does the public support the proposed project? Members of the public may have indicated that a bridge or road needed improvement, but may not approve of the suggested solution.
- Is the funding mechanism proposed for the project acceptable? Funding scenarios that call for increasing taxes or assessing new fees will likely be met with some opposition. A project which is cost effective over the long term and which will save taxpayers money in the future will receive greater support.
- If the project is delayed, will the public respond negatively? Various funding strategies may result in the postponement or phasing of improvements overtime. The public may feel that the bridge or road project should be undertaken immediately.

C. Environmental Considerations

Environmental considerations can play a significant role in the selection of a preferred alternative. Transportation infrastructure projects can result in a number of impacts. These include impacts to natural and cultural resources as well as those that affect the social and economic fabric of the community. Whenever federal funds are used for road and bridge projects, the potential environmental impacts must be assessed under the provisions of the National Environmental Protection Act (NEPA). MDT is responsible for NEPA compliance on all of those projects which it administers and that are funded by federal dollars. State and county projects that are funded by state dollars only are subject to the environmental assessment process established under the Montana Environmental Protection Act (MEPA).

Often, funding applications for bridge and road assistance will require that an environmental assessment be prepared in conjunction with the application. Project planning should include adequate time to conduct environmental assessments where appropriate to determine the nature of any anticipated impacts and how they might be mitigated. Questions related to project specific environmental assessments can be directed to the Environmental Services Division of the MDT and other agencies that are being considered in the funding of the project. Each agency may have somewhat different environmental requirements, so it is important to contact each funding agency that might be involved in the project.

Air Quality Issues

A number of Montana counties and cities are facing some difficult problems related to air quality. Portions of these counties have been designated as "non-attainment" areas for their failure to meet air quality standards for one or more standards. Of particular concern is the air quality standard for respirable particulate (such as dust), which is matter that can be breathed into the lungs. Counties can get assistance in dealing with air quality concerns related to transportation infrastructure through the urban planning

and special studies sections of the MDT Planning Division. Local health officials should know the air quality status of a county or city. Air quality concerns should be incorporated into overall area transportation infrastructure planning.

- **Water Resource Issues**

Road construction can result in siltation problems that can negatively impact waterways. Roads often follow the natural corridors created by rivers and streams. Project design must include ways in which to prevent gravels, sands and other materials from washing or eroding into the water. Siltation fences are typically erected during the course of construction to prevent siltation of streams and rivers during this phase. Certain types of improvements to water crossings can also result in damage to the waterway. For example, if not constructed properly, low water cement crossings, can result in the build up of materials up stream of the crossing and erosion downstream.

- **Cultural Resource Issues**

Roads and bridges are part of Montana's "cultural landscape." MDT should be consulted regarding potential impacts on historic resources that might occur as a result of bridge or road construction. MDT staff are currently preparing a *Roads and Bridges Historic Preservation Plan* that includes provisions for how MDT will manage and interpret its historic roads and bridges, as well as education programs to present the history of Montana's roads and bridges to the public. The state has identified 100 off-system bridges that are on or eligible for listing in the National Register of Historic Places. For these bridges, rehabilitation is preferred over replacement.

- **Social and Economic Impact Issues**

Improvements to roads and bridges can often result in changes to existing travel patterns. For example, a newly improved road often will experience an increase in average daily trips. Residential areas might be required to contend with additional noise and disruption associated with heavier traffic. Rerouting a road might negatively impact existing businesses that might have previously enjoyed better access. On the other hand, improving road and bridge conditions can assist a county in meeting certain economic development objectives, providing better access for markets, improving travel safety, and enabling new residential growth.

D. Other Issues

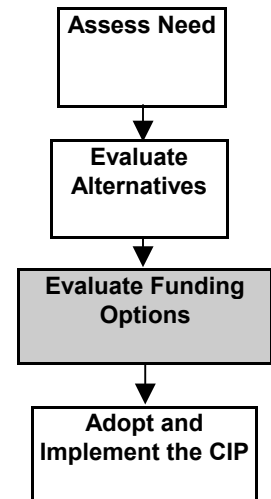
In addition to the items described above, there are some additional questions that should be addressed in the evaluation of alternative solutions:

- Is the project scheduled for implementation by the MDT? The various programs of MDT, described in Chapter 4, often entail a waiting period of months or years. Alternative funding mechanisms may help move the project along at a quicker rate.
- Does the bridge or road have other values that should be considered? Is the bridge historic? Does the road have scenic or recreation values?
- Does the bridge or road provide access to fishing, wildlife viewing, hunting or other forms of recreation? Do these considerations affect the manner in which improvements should be undertaken and therefore the cost?

- How does the project relate to other county goals and objectives? Does the project assist in economic and community development efforts? Does it provide support for other critical services such as emergency medical providers? Does it address changing settlement patterns?

CHAPTER 4. EVALUATING FUNDING OPTIONS

Once priority projects have been identified and alternative solutions evaluated, the county takes a comprehensive look at its capacity to pay for the desired improvements locally as well as to outside funding that might be directed to specific projects. This involves identifying the various specific legal and administrative requirements that must be fulfilled, funding cycles and program criteria. Financial strategies should be developed with respect to the county's financial status and the availability and appropriateness of outside funding sources.



I. Introduction

Once priority projects have been identified, the next step is to develop a corresponding financial strategy for implementation. Funding options need to be evaluated in order to develop a plan to finance road and bridge projects. A detailed list of funding sources can be found in Appendix C.

II. Evaluation of Funding Options

Financial planning begins with an evaluation of the county's current fiscal status, existing budgetary requirements and commitments for all sources of revenue -- tax and non tax. Where possible the county should anticipate trends affecting revenue sources. Revenue fluctuation can occur as a result of population growth and decline, shifts in industrial production, and as a consequence of statutory or administrative changes at the state and federal levels (e.g. changes in the methods that the state employs in assessing property values). Once local financial capacity has been evaluated, the county can consider outside sources to fill gaps where necessary. Proposals for outside funding must present a strong case regarding insufficient local financial capacity. In most cases, outside dollars will be awarded by a funding agency only as a compliment to local dollars rather than a convenient substitute.

Good fiscal planning can enhance a county's ability to adequately address overall community needs. A thorough analysis of local funding options, and their applicability and feasibility for bridge and road infrastructure, is extremely important. The following

questions should be included in this analysis:

- Is the county levying the maximum number of mills for bridge and road maintenance, repair and construction allowed under local and state statutes (and with respect to Initiative 105)?
- Can the county borrow funds or issue bonds to pay for road or bridge projects?
- What economic and community development trends will affect the overall tax base?
- What are the general economic and demographic conditions in the county that might affect the ability of property tax payers to carry the burden of additional levies or assessments?

While a county has a variety of funding options at the local level to address bridge and road needs, those resources may already be tapped to their limit for other uses. In addition, the limitations imposed by Initiative 105 and found in 15-10-402, MCA, can often prohibit the levying of additional mills for bridge and road improvements without voter approval. Initiative 105 placed budgetary limitations on local governments that prevent them from increasing their revenue over 1986 levels. In order to increase appropriations, counties may present financing proposals to the voters for approval. For example, in an attempt to provide local matching funds for a state or federal grant, the county may seek voter approval of a mill levy increase or a general obligation bond issue, or initiate the creation of a rural improvement district. Voters may reject the notion of paying additional taxes or fees. In such instances, it may be necessary to ask residents to take on a smaller portion of the total cost. Voters may respond more favorably when it can be demonstrated that they are not carrying all of the burden. Rather, for each dollar they pay, they would be leveraging one or more outside dollars.

Specific funding approaches may require a readjustment in design or a division of the project into phases, which are in keeping with local funding capacity and/or the availability of grants or loans from outside funding sources. This information can then be added to the analysis of alternative project solutions and evaluated in accordance with those priorities listed in the county bridge and road needs assessment. Once financing information has been amassed, it may be necessary to re-evaluate priorities and alternative solutions. A "financing plan" generally incorporates the following elements:

- Costs associated with each bridge and road project and project alternative (e.g. replacement vs. repair), and for phased projects, costs attributed to each phase of project development (e.g. engineering and design, year one improvements, year two improvements, etc.)
- An analysis of potential local and outside sources of funds for each project and/or project phase which includes:
 - Funding availability of each source (amounts, funding cycles, lead time required)
 - Special concerns and requirements (e.g. elections, public hearings, environmental and cultural resources assessments, other special program criteria)
- A project funding time line that identifies critical deadlines for application

preparation and submittal, the passing of necessary resolutions and ordinances, and other approvals as required.

III. Project Costs

As stated in the previous chapter, project cost information should be carefully prepared. Estimates should be based on professional engineering designs when possible. Many funding programs will *require* that cost estimates be prepared by registered engineers. While county road personnel staff may have extensive experience in designing projects and estimating costs, outside engineering consultants can offer more objectivity and expertise based on a wider range of experience. Inexpensive solutions are not always the best, and estimates should take into account the life of the proposed improvements. For example, what are the anticipated maintenance requirements of the project and their projected costs over time? Is the project cost in keeping with the overall financial capacity of the county measured in terms of its tax base, population and anticipated growth or decline? One of the statutory criteria used to evaluate applications to the Treasure State Endowment Program looks specifically at this issue: Does the project make use of cost-effective design and provide a thorough, long term solution to community public facility needs?

IV. Availability of Funding

Specific information regarding funding programs and sources can be found in Appendix C. The list includes a description of both local and outside funding sources, eligibility requirements, application requirements (as appropriate) and agency contacts for outside sources.

Many of the outside funding programs listed in this chapter have lengthy application review periods and funding may not be provided for months or years. For many programs, counties should anticipate a lead time of at least two years in advance of project implementation. In other cases, state or federal funding has already been committed for a number of years into the future. For example, the federal off-system bridge program has allocated all funds for projects through the year 2006, unless Congress appropriates additional monies.

IV. Keeping Track of Funding Sources

As counties review various sources of funding that may be applied to road and bridge projects, they might want to develop a matrix or chart of information which can be useful as they analyze their financing options. A matrix can be a useful tool in making presentations at public meetings and as an aid in decision making.

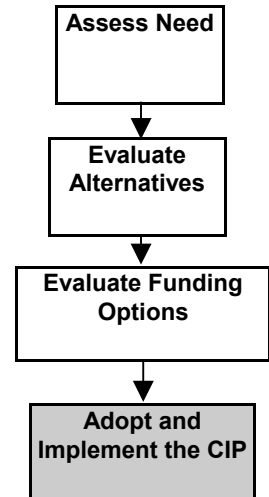
Table 4-1 Analysis of Local Financial Capacity

Funding Source	In Place?	Amount	Current Debt Obligations (Duration)	Discretionary Funds	Eligible uses	Effects of Initiative 105	Other Comments
Bridge and road mills							
Fuel Excise Tax							
SID/RID							

A table of funding sources, which can be used as a quick reference, follows the detailed funding source list at the end of Appendix C.

CHAPTER 5. ADOPTING AND IMPLEMENTING THE CAPITAL IMPROVEMENTS PLAN

Once the county has defined and measured needs, evaluated solutions for its highest priorities and identified funding strategies, all the elements are present to adopt and implement a capital improvements plan (CIP) for roads and bridges. The formal adoption of the CIP provides the mechanism for county personnel to implement the projects identified. The CIP is typically prepared for a 5-year period and should be reviewed annually in conjunction with the regular county budgeting process. The adoption and implementation of the CIP should also be incorporated into the overall process of county land use and community development planning.



I. Introduction ~ Putting Together the Plan

The elements of a capital improvement plan (CIP) have been described in the previous three chapters, i.e., the needs assessment, the ranking of project priorities, the identification of solutions and alternatives, and an evaluation of financing options. For each of the highest priority needs, the county has identified alternative project solutions, costs, and suggested funding scenarios. The next steps in the planning process include the preparation, adoption and implementation of a CIP.

A. Developing a Comprehensive Funding Strategy

Once funding sources have been identified and evaluated as to their applicability to various projects, the next step is to match projects to funding sources. For example, a county may propose to fund a bridge reconstruction through a combination of funds including the local bridge fund, a grant from the Treasure State Endowment Program and a loan through the Intercap program. Each project identified in the CIP (*which typically covers a five-year period*) should have a corresponding funding scenario, which will be used to prepare the overall budget for the bridge and road capital improvement plan.

Suggested funding scenarios for each project should be drafted in keeping with the following:

- specific program criteria (e.g., does this project address job creation, or the needs of low and moderate income persons?)

- the availability of funds over time
- grant or loan matching requirements
- grant or loan ceilings
- local administrative requirements (resolutions, ordinances, elections, preparation of bond sale documents, creation of special districts, etc.)
- county resources available for application preparation including the assembly of necessary documentation

Funding strategies that make use of a variety of funding sources are likely to be more successful. Most funding entities prefer to see other funding sources as part of the financial package, where their investment can leverage funds from other sources (local and outside). Also, funding strategies that are not necessarily dependent on one specific source are less vulnerable to changes in funding availability. The following matrix provides an example of how project funding strategies may be presented. The matrix should be formatted to reflect the time schedule presented in the 5-year CIP.

Table 5-1 Capital Improvement Plan Matrix

Project Priority	Project Year (1-5) per CIP	Project Name	Project Cost	Funding Source Contribution	Funding Sources	Application Timing Requirements
1	Year 1	Bridge - Hwy 37 Replacement	\$160,000	\$60,000 20,000 80,000	Off System Bridge, SOS TSEP	MDT Approx. 1998 MDT Approx. 1998 June, 1997
2	Year 1	Paving - Hwy 14	\$150,000	\$100,000 50,000	SOS, Rural Improv. Dist.	MDT Approx. 1998 election: May, 1998
3	Year 2	W. Side Bridge Rehabilitation	\$125,000	\$50,000 25,000 50,000	Intercap loan local funds rural development	ongoing July, 1999 ongoing, 1999
4	Year 3	Bridge - FS 42 Replacement	\$120,000	\$50,000 60,000 10,000	Wood in Transportation TSEP Local Funds	December, 1999 June, 1999 July, 2000
5	Year 4	Paving/overlay - Hwy 3	\$75,000	\$75,000	Local Funds	July, 2001
6	Year 5	Bridge-Lake Drive -	\$40,000	\$20,000 20,000	Local Funds TSEP	July, 2002 June, 2001

		Replace with Culvert				
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B. Identifying Implementation Tasks

In addition, the CIP should include the various tasks necessary for implementation from the point of its adoption. These might include the following:

- The preparation of funding applications and support documents
- Conducting elections for voter approved levies
- Incorporating specific recommendations into the overall county budgeting program
- Hiring consultants (as necessary)
- Preparing bid documents
- Project Management
- Financial Management
- Working with bond underwriters and associated legal service providers

The tasks can be used in the preparation of a **time line** that assists staff and elected officials measure progress. It alerts county officials regarding critical dates and enables planning to take place in a timely fashion. The time line should also be included as part of the plan.

The plan should include provisions for project management. Each task and program element should be assigned to a specific department and individual, or to the county commissioners as appropriate. The assignment of responsibility should be adopted as part of the plan to assure implementation. Without this component, implementation will be more difficult to achieve.

Finally the plan should include a procedure for regular **updates** that involves county staff, commissioners and members of the public. Updates should be tied to the county budgeting cycle in order to assure that county fiscal planning is undertaken with respect to the 5-year CIP. One simple way to update the plan is to review it annually. A new year can be added each year, maintaining the five year approach. The plan should be *clearly* presented in order to facilitate updates and its accessibility to the public. Further, as elected and appointed officials change over time, it is important to provide them with information that can be quickly understood and incorporated into their administrations.

C. Maintenance Schedules and Programs

The CIP should include a maintenance schedule for the county's equipment, roadways and bridges. As stated in Chapter 3 - Evaluating Alternatives, maintenance requirements should be taken into consideration when evaluating a proposed project. This enables a county to measure the long term costs associated with various alternatives. In addition, a program of regular maintenance prolongs the life of a county's transportation infrastructure. The CIP should identify the costs associated with

the maintenance program (for both existing and proposed elements of the transportation system) and, like other elements of the CIP, the sources of funds should be identified. For example, a county might wish to establish an improvement district for road maintenance.

II. Adopting the Plan

The bridge and road capital improvement plan can be adopted by resolution by the board of county commissioners. The planning process should involve members of the public throughout as described in Chapter 2, and a public hearing to adopt the plan is highly encouraged. The first and subsequent years' activities outlined in the capital improvement plan should also be part of each annual budget where appropriate. For example, if a county plans to use a rural improvement district, or general obligation bond to finance bridge or road infrastructure, it should give itself the necessary budget authority to use the funds collected. The plan can be adopted as part of a larger county-wide capital improvements plan which is more typical, but is not legally required. As stated earlier, however, some funding programs may require that counties identify bridge and road needs as part of their overall requirements.

As stated above, the plan should include a mechanism for regular updates which will occur during the five years to which it applies. For example, the CIP may call for yearly updates, in conjunction with the overall county annual budget preparation. In addition, the CIP may have to be revised periodically to reflect unexpected changes in the county's revenue stream (e.g. changes in its industrial base, new residential developments, etc.) The plan would set forth bridge and road projects for a period of five years. At the conclusion of the five years, the existing plan would be substantially amended or replaced by a new plan covering the next five years of proposed capital improvements projects.

III. Implementing the Plan

The formal adoption of the CIP enables county personnel to implement the road, bridge and other projects identified. The CIP provides a useful guide for individual project development and often contains the information required to prepare funding applications to various agencies. The plan also provides easy, accessible information to elected officials who change over time but are obligated to follow a previously adopted course of action.

A. Preparing Funding Applications

Counties may sometimes be overwhelmed by the apparent complexity of requirements associated with preparing funding applications. Limited staff and resources can make the preparation of grant and loan applications challenging. However, the process of preparing funding applications can be made simpler if the county can anticipate many of the requirements in advance of deadlines. Having a capital improvements plan in place reduces the work involved in preparing funding applications. Many of the specific requirements are common to a variety of programs. Increasingly, state and federal

agencies are working together to simplify the process and where possible are assisting counties in developing a more universal approach to their planning process to assure better compliance with a variety of program requirements. For example, many applications require an environmental assessment of the potential impacts of the bridge or road project. Some programs require formal action by the board of county commissioners, survey data, census information, employment figures, etc.

The bridge and road capital improvement planning process will provide a good basis for most applications for funding. In undertaking this process, counties will have already prepared much of the information required by most funding agencies. In addition to the capital improvements plan, we also suggest that the county commission maintain a "notebook" containing information that will likely be used over and over again for grant and loan applications, letters of inquiry to potential funders, in public presentations and press releases. Once this information is prepared it can be easily updated. The following is a suggested list of items, but is not necessarily all inclusive:

- Needs Assessment Summaries (survey results, engineering studies, etc.)
- Descriptive information concerning the number, type, condition and load limits of bridges, and road quality and type, measured in miles
- Use Information: daily vehicle counts, types of use, e.g. commercial, residential, etc.
- Resolutions, ordinances, petitions that relate to project requirements
- Minutes from public meetings where bridge and road infrastructure is discussed
- Newspaper articles addressing bridge and road needs
- The most recent census data for the county
- Information about the county including its population, tax base, economic characteristics, unemployment rates, average income, infrastructure condition
- County staffing for bridge and road programs and financial management
- Any related surveys including cultural resources assessments, land use information, environmental conditions, income surveys

Many of the grant and loan programs that are available at the state and federal levels are governed by a number of requirements. As indicated above, public infrastructure projects must often address a variety of objectives including economic development, health and safety concerns, the needs of low and moderate income persons, historic preservation, and the mitigation of environmental problems in order to be competitive. The "notebook" of information should include as much information as possible regarding each of these areas of concern. To the greatest extent possible, the county should prepare standard responses to potential questions that will likely appear on most applications.

1. Creating a Special Funding Committee

In many counties, one individual is responsible for completing funding applications. Often this person has other duties as well and might serve the county as the budget or finance director, clerk, planning director, or perhaps as one of the commissioners. Some counties hire consultants to prepare applications. It can be very helpful to establish a small committee of persons to work with the grant writer and county

commissioners to assist in finding information, assembling documents, preparing specific sections and editing. The county grant writer can work with the committee to identify tasks and delegate them as appropriate. It is important that a single individual maintain overall responsibility for application preparation, however, to maintain consistency and oversight. The committee should also make use of a time line as an organizational tool to make sure that applications and other documents are prepared on schedule in order to meet agency deadlines. If a deadline is missed, a project could be delayed by months or years. The committee may also conduct public education programs that are being developed to inform the public about bridge and road projects and how local and outside sources of funding are being directed to resolve specific problems. Committee members need not be elected or appointed officials.

2. Technical Assistance

There are a number of sources that a county can tap for technical assistance in understanding and preparing funding applications. The Cooperative Extension Service of Montana State University has a number of community development specialists available to help local governments. Extension Service staff can assist local governments in setting priorities, preparing applications and in facilitating public meetings. Montana also has several Resource Conservation and Development entities (RC&D's), which have been established jointly by the Federal Natural Resources Conservation Service of the Department of Agriculture and local groups. These include the Beartooth RC&D of Red Lodge, the Bitterroot RC&D in Hamilton and the Headwaters RC&D in Butte. RC&D's are typically organized by a number of counties to create regional organizations. RC&D staff often work with local governments in preparing funding applications. RC&D's and Cooperative Extension agents can also assist in identifying funding sources and in designing public participation programs.

Several cities and counties have also formed multi-jurisdictional development organizations that can also assist in preparing funding applications. These include the Bear Paw Development Corporation of Northern Montana based in Havre and the Great Northern Development Corporation in Wolf Point.

The public agencies that administer various funding programs, can also provide assistance to county governments that are preparing applications. In fact it is recommended that counties meet with agency staff to discuss their projects in advance of completing applications. This will enable a better understanding of program guidelines and the criteria that should be addressed. The Community Technical Assistance Program (CTAP) of the Montana Department of Commerce is specifically charged with assisting communities with city and county planning and infrastructure financing (Telephone: 406-444-3757). CTAP can often provide a good starting place in seeking information.

The Montana Department of Transportation is very interested in helping counties plan and implement bridge and road improvement programs. The Department will typically be involved in various aspects of both planning and implementation. Their staff often works with counties in identifying innovative funding strategies and in assisting with the preparation of applications. In doing so, they are able to leverage their program dollars

to a greater degree.

3. Combining Funding Sources and Expertise

Counties often employ a number of funding strategies in order to raise the money required to finance their transportation infrastructures. Using a variety of funding sources enables a county to address critical problems more quickly. The federal "Highway Bridge Replacement and Rehabilitation Program" (HBRRP) which funds both on and off-system bridges has a waiting list which, in some cases, is as long as 10 years, while other funding sources, such as the Intercap program, may be accessed almost immediately. Combining funding sources also brings more technical expertise to the project. Funding partners can work together to identify appropriate solutions as well as provide the dollars to implement the project. The Montana Department of Transportation can still fulfill its responsibilities to assure that projects meet state and federal standards, even when other funding sources are being used. In addition, each participating agency can assist the county in addressing specific areas of concern. For example, a project funded jointly by the Wood in Transportation Program of the Forest Service, the Montana Department of Fish, Wildlife and Parks and the Save Our Secondary Road Program will reflect concerns regarding economic development, access to public lands or streams, environmental issues and transportation safety issues.

Funding entities are more likely to invest in a project if there are multiple participants. A joint effort translates into a greater return on each dollar invested in the project. An agency is simply more likely to contribute to a project if, by doing so, it can leverage other contributions. The Montana Department of Transportation can work with county commissioners and their road personnel in bringing various programs together to assist in a county bridge or road project. Examples of funding partnerships include the following:

- Intercap financing of a bridge or road project, the debt financed through the creation of a rural special improvement district.
- Treasure State Endowment Program (TSEP) grant funding of a bridge reconstruction with matching funds provided by MDT, the Wood in Transportation Program and a small local bond issue.
- In counties with large urban centers, tax increment financing dollars might be directed to a bridge project through a cooperative agreement between the county and the incorporated area where the tax increment district is located. Matching dollars might come from the county bridge budget, MDT administered funding, or a small local bond issue.
- Highway enhancement funds might be used to convert a functionally obsolete bridge to pedestrian use in order to mitigate the potential loss of an historically significant structure, in conjunction with an overall bridge replacement project.
- Rural Development funds (formerly Farmers Home Administration) might be used to leverage Community Development Block Grant and TSEP funds.

B. Financial Management

Counties, as per local and state statutes, must comply with various requirements

regarding the appropriation and expenditure of funds. In addition, there are a number of responsibilities associated with managing projects that are supported in whole or in part by outside funding. These responsibilities vary from program to program. Those common to most include the following:

- Complete documentation should be prepared for each financial transaction, for both expenditures and receipts. Documentation should be kept for all transactions, even if they are not all covered by the outside funding source. Often funding entities will review all project expenditures, even those covered by the local share.
- A complete record should be kept of all project documents including:
 - Requests for proposals from consultants
 - Responses to proposal requests
 - Processes used to select consultants
 - Construction and bid documents
 - Commissioner actions authorizing the advertisements for bids or proposals
 - Copies of legal notices
 - Bid and performance bonds
 - Contract awards
 - Project progress reports
- Periodic project reports should be prepared, usually covering a period of three to six months. Some agencies provide specific formats for progress reports.

The person responsible for managing the finances associated with a particular project should keep a journal that notes various activities and dates of those activities. This information will be very useful in preparing financial and progress reports to both the county commission and the funding agency.

IV. Coordination with other Agencies and Partners

Counties are encouraged to work with a variety of project partners in preparing and implementing their bridge and road capital improvement plan. The various funding agencies as well as the technical assistance providers can all be valuable participants. Their involvement can help address complex issues before they become an impediment. While counties are strongly committed to resolving problems locally, they are responsible for addressing concerns that are important to all Montanans. The lion's share of our transportation infrastructure may be the responsibility of the counties, but county bridges and roads serve regional, state-wide and even national transportation needs. In many counties, a large percentage of the land is managed on behalf of the public by various state and federal agencies. These public land managers are keenly interested in transportation issues. As stated earlier, opportunities to coordinate activities and share resources with public agencies are extensive. They offer a way to extend limited resources and to develop projects that are useful to a variety of

constituencies.

Public ~ private partnerships are also an important component in implementing capital improvement plans, particularly when transportation infrastructure improvements will benefit a particular business or residential area. Private entities can partner with county governments in funding and managing infrastructure. Many of Montana's bridges and roads have been built to serve logging, agriculture, mining and other industrial activities by private concerns. Representatives of these interests should be included in discussions regarding planned transportation improvements.

A. Cooperative Approaches

In Montana, working together cooperatively is a long standing custom. Cooperative arrangements among local governments, state and federal agencies, property owners, special districts, private organizations and businesses are commonplace. So-called "partnership strategies" are part of the very fabric of Montana. Recently, for example, a bridge project was undertaken jointly by Teton and Cascade Counties, a private landowner and the Department of Fish, Wildlife and Parks.

The U.S. Forest Service often works with counties to address bridge and road needs. In the course of preparing a timber sale, the Forest Service evaluates the potential impacts on infrastructure on both federal and county land. This evaluation might reveal that a county may have a bridge that could not handle the additional load from an increased number of logging trucks. The Forest Service may then direct some of the funds from the timber sale to reinforce the bridge. The county may also assist with financing improvements in light of the long term benefit to the county once the timber harvest is complete. In other cases, the county might assist with bridge inspections while the Forest Service undertakes the repairs. The Bureau of Land Management (BLM) makes gravel available to local governments for road maintenance at no cost if those resources are available on BLM lands.

Relationships are often formalized through the use of cooperative agreements. The Department of Defense, for example, enters into agreements with county governments for snow removal on roads that provide access to missile sites. Payments are made directly to the county in return for services performed. Partnerships also occur as a result of joint funding. For example, bridge project on the Smith River at Camp Baker in Meagher County brought the county, the Montana Department of Fish, Wildlife and Parks and the Montana Department of Transportation together to provide expertise and funding. Such partnerships can help resolve complex issues associated with project impacts. Various agencies, in keeping with their mandates, can work together to address design concerns that might have direct bearing on project costs, environmental matters and long term maintenance.

B. Regional Approaches

Increasingly, Montana counties are working cooperatively to share resources and expertise. There are a variety of examples of regional efforts including the above mentioned RC&D program, Human Resource Councils and the Montana tourism regions established by Travel Montana. The Montana Association of Counties has

divided its membership into a number of regions and the Montana Department of Transportation (MDT) manages many of its programs through five financial districts. In many cases, these various regional entities are providing technical assistance to county governments. Services include education and training in preparing funding proposals, in identifying human and financial resources and in community planning. Cooperative Extension Agents are often responsible for multiple counties and provide assistance to their constituents in a number of areas as well. In addition, Federal land managers are responsible for public lands that extend over a number of counties. Forest Service and Bureau of Land Management planners work with local governments within an entire region on a number of issues related to community development and infrastructure.

It may serve Montana counties, particularly those without major urban centers to look at other regional approaches to meet their needs. Perhaps two or three counties might be able to share in the cost of hiring an administrative aide who could assist county commissioners and other county staff in preparing needs assessments and funding applications, managing professional contracts, overseeing construction and managing various funding programs for a variety of county infrastructure needs including bridges and roads. This person might be housed within a regional office of one of the agencies listed above through a cooperative agreement. Funding for this program might come from a combination of sources including the counties, a special purpose grant, and donations of space and administrative overhead by a participating agency.

C. Sharing Experiences

The survey of Montana counties revealed that a number of counties have employed innovative strategies to address bridge and road needs, even in light of few resources. For example, some counties are minimizing the amount of time that equipment is down for repairs through the acquisition of new, more reliable equipment. Purchases are made more affordable using depreciation reserve accounts and special lease purchase agreements with buy back options. A number of counties have successfully combined programs and funding sources in order to expedite a project and to make it more affordable. Still others are using new technologies in maintaining their bridge and road infrastructure. County commissioners and road personnel have an opportunity to share these experiences with their counterparts at various meetings and conventions throughout the year. In addition, counties, working with the Montana Association of Counties (MACo), cooperative extension agents, RC&D's, can share information. The Rural Technical Assistance Program at the Montana State University also provides a clearing house of information and technical assistance to communities on transportation infrastructure. They can be reached by calling 1-800-541-6671.

V. Other Issues

Finally, the development and implementation of a CIP for roads and bridges should be undertaken within the broad spectrum of county concerns and issues. For example, **bridge and road concerns should be incorporated into county-wide community development and land use policy decisions.** Administratively, data regarding road and bridge infrastructure condition should be well managed and integrated into the

county's information base to facilitate informed decision making.

A. Information Management

The manner in which counties keep track of road and bridge condition varies considerably. Generally, counties rely on the information provided by their road departments, road supervisors and public comment to determine the condition of roads and bridges under 20 feet in length. In some counties, each county commissioner serves as the road supervisor for his or her district. A number of counties undertake a regular program of inspection on a cyclical basis. Some work in a specific section of a county and address all the road maintenance needs before moving on to the next area. In Hill County, a special committee representing farmers in each of the three commissioner districts advise the commissioners on road projects. Most counties rely on the MDT conducted two-year inspection cycle for bridges over 20 feet. A couple of counties work cooperatively with the Montana Department of Transportation to conduct bridge inspections for bridges under 20 feet. A few employ a rating system and try to undertake a certain number of projects each year (Richland County, for example). Teton County maintains an extensive inventory of its roads and rates their condition -- good, fair or poor. However, given that road crews are frequently overtaxed, they are often unable to inspect the entire county's transportation infrastructure each year.

Counties maintain very specific information on the number of road miles because this information is used to calculate their gas tax allocation. However, many counties do not maintain information on the number of bridges and their condition, particularly those under 20 feet. Overall, this lack of information makes it difficult to conduct overall needs assessments and develop priorities objectively. In identifying bridge and road projects, most counties give priority to school bus routes, mail routes, main arteries serving residential areas (those with heavier traffic) and certain roads which serve industrial or agriculture-related commerce. Priorities generally follow the assessment patterns.

A few counties make use of computer-based road management systems, but generally have not felt comfortable with the technology and continue to rely on more traditional methods of assessing condition. Computer-based technology at the state and district level is continually being updated to make it more reliable and "user friendly". However, this technology has not yet been applied to secondary or off-system roads. Over time, as the technology is expanded, counties will be able to conduct needs assessments and set priorities more efficiently. In the meantime, counties might work with the Montana Departments of Transportation and Commerce to identify ways in which information can be managed in a manner that is more useful.

B. Land Use Planning Issues

Ultimately, road and bridge needs are directly tied to land use. County governments often find themselves in a reactive role regarding transportation facilities development. The survey conducted in conjunction with the preparation of this manual revealed that county road and bridge budgets were increasingly taxed by new residential developments in rural areas. While new development brings dollars to the county tax base, there is often not enough new revenue to offset the increased need for services, particularly when the development occurs some distance from available services.

Capital facilities planning and land use planning should be integrated in a manner which reveals all of the costs associated with development so that more thoughtful, long-term decisions can be made. For example, the county commissioners, county planning board and county planner (or consultant) can work together, and share ideas for this integration, during the preparation of a county's road and bridge CIP. Cooperative relationships among developers, property owners and local governments should be encouraged to help address anticipated transportation needs as a first step in the county land and community planning process. In doing so, counties can reduce the cost of providing transportation infrastructure to county businesses and residents. The CIP for roads and bridges should, at the very least, include a discussion of land use planning concerns as a guide to decision making. As counties undertake to prepare and update their county comprehensive plans, transportation concerns should be addressed thoroughly.

Appendix

Appendix A

Bridge and Road Manual Project Survey Component

I. Introduction

As a first step in the preparation of this manual, the consultants undertook a survey of Montana's 56 counties to learn how they were currently evaluating the condition of their bridges and roads, and how they were financing repairs, rehabilitation and reconstruction projects. The consultants were successful in reaching 80 percent (44) of the counties. Road personnel and county commissioners (who in some cases also serve as road supervisors) were interviewed by phone during July of 1996. Road supervisors and county commissioners were unavailable in the remainder of counties. Where possible, data was provided by MACo. Upon request, the Treasure State Endowment Program will provide the survey results.

The survey revealed that while the number of road miles in each county was readily available, information regarding the number of bridges and their condition was often sketchy and inconsistent from county to county. Generally, counties rely on the information provided by their road patrols, road supervisors and members of the public to determine the condition of roads and bridges under 20 feet in length.

A number of counties (Hill, Gallatin and Broadwater, for example) undertake a regular program of inspection on a cyclical basis and undertake projects by geographic area. Others have established rating systems to establish priority projects each year. County staff often works with residents to define priorities, typically giving greater attention to school bus routes, mail routes, roads that serve industrial or agriculture-related commerce and concentrations of residential development. Only a few counties are using or considering the use of computer-based pavement management systems, but are unsure as to whether existing technology can provide an accurate portrayal of condition. For the most part, counties lack the personnel and financial resources to undertake comprehensive bridge and road planning and simply try to respond to critical needs.

Many counties expressed dismay over the process required to secure outside funding and noted that in some cases the costs for assembling an application and the preliminary engineering work were out of proportion to the funds being sought. County personnel surveyed noted that a manual which assists them in preparing funding proposals and scheduling projects in an efficient manner would be very helpful in meeting their bridge and road needs.

II. Assessments and Priorities

Generally, counties rely on the information provided by their road patrols, road supervisors and public comment to determine the condition of roads and bridges under 20 feet in length. In some counties, each county commissioner serves as the road supervisor for his or her district. A number of counties undertake a regular program of inspection on a cyclical basis. Some work in a specific section of a county and address all the maintenance needs before moving on to the next sections. Generally, counties find they are responding to critical needs in assessing road and bridge infrastructure. In only a few cases, did counties use outside technical services to assess road and bridge condition. In Hill County, a special committee representing farmers in each of the three commissioner districts advise the Commissioners on road projects. Most counties rely on the two-year inspection cycle for bridges over 20 feet. A couple of counties work cooperatively with the State to conduct bridge inspections. Only a few counties are using or contemplating using pavement management systems. Those computer systems in use are not necessarily perceived as providing an accurate portrayal of condition. Stillwater County has received training through a special inspection school in Minnesota for their bridge supervisor.

Counties rely largely on bridge assessments undertaken by the state, although some do their own assessments. Bridges under 20 feet long are assessed based on county personnel observation. Most do not do regular assessments of bridges under 20 feet. Many commented that they are replacing deteriorating small bridges with pipe culverts.

Generally counties undertake road assessments themselves. As stated above, a few employ a regular maintenance schedule. Most give priority to school bus routes, mail routes, main arteries serving residential areas (those with heavier traffic) and certain roads which serve industrial or agriculture-related commerce. Inspections are undertaken by county road personnel or county commissioners who serve as road supervisors for their individual districts. Issues are brought to county commissioners and other road personnel by constituents. Depending on the county, some road personnel are given more discretion than in others. Priorities follow the assessment patterns. The most critical projects are addressed first. As stated above, school bus routes and routes with the most traffic or commercial use are addressed first. A few counties employ a rating system and try to undertake a certain number of projects each year (Richland County, for example).

III. Funding

The number of mills levied for roads varies but averages between 10 and 20. A couple levied fewer than 5 and a few levied more than 20 (those with special county classification). Many, but not all, of the counties levy 2 to 4 mills for bridges. This is a county wide mill and is higher in value than the road mills which are exclusively based on taxable valuation outside incorporated towns and cities. (Note: Road mills are levied based on a county only mill value, exclusive of incorporated cities and towns,

while bridge mills are county-wide and include both incorporated and unincorporated areas.) In addition, some counties (e.g. Teton, Gallatin) have also taken advantage of the ability to levy up to two emergency bridge mills. Many counties use a portion of the optional .5 percent vehicle tax for roads. All receive gas tax funds and the \$10.00 per license fee. A few counties mentioned that bridge dollars are often diverted to road budgets.

All counties with federal land receive PILT funds and some receive timber receipt revenue. In some cases, all of the PILT receipts go into general fund but in other cases some of these funds are directed to the road budget. Timber receipts are divided among the schools and the road budgets. Others have entered into cooperative arrangements with the Forest Service for inspections and maintenance and sometimes construction. Oil-producing counties have suffered a decrease in oil related income. Changes in the method of calculation and distribution of taxes from oil have meant a loss of \$233 per well in Hill county (from \$250 to \$17), funds which are directed to the road budget. In north-central Montana, arrangements have been made with the Federal government to maintain those roads associated with the missile network and others associated with the Malmstrom Air Force Base. A couple of counties were engaged in special demonstration projects that enabled them to match a series of programs together. In Meagher County a partnership has been formed with the Montana Departments of Transportation and Fish, Wildlife and Parks to address the Camp Baker Bridge, which provides recreational access to the Smith River.

A number of counties undertake bridge projects with the SOS (Save Our Secondaries) Program. Three counties had either applied or were considering using TSEP funds for bridge work. Many were not aware that TSEP provided funds for bridges. Some have made use of FEMA funds for bridges although many commented that these funds were often two years in coming and could only be used to repair a bridge to its pre-existing standards rather than to bring a bridge to a higher standard. Many expressed dismay over the process required to secure outside funding, and noted that, in some cases the costs for assembling an application and the preliminary engineering work were out of proportion to the funds being sought.

With the exception of one Rural Improvement District (RID) in Choteau County for a bridge project, the overwhelming majority of RID's have been used for roads. Some of these are homeowner managed. Gallatin County undertakes cooperative agreements with homeowners to fund roads. Hill County will cooperatively work with private property owners. Hill County will contribute 1/3 of the cost of the road project and the private sector will provide 2/3. Funds are amassed all at once, rather than borrowed against annual assessments.

Some of those counties, which are experiencing growth, are looking at development impact fees for road maintenance. None mentioned bridges in this context.

Other counties noted that increasing residential development, combined with decreasing resource based industry, was creating a funding problem. In Jefferson County, for example, a \$100,00 home contributes only \$16 annually to the road budget.

During a recent suspension of mining at the Golden Sunlight Mine in that county, the county lost \$700,000 in taxable valuation attributed to gross proceeds. In Mussellshell County, the addition of 2,000 new residents in the last few years has stretched their funding to the limit. Many road and bridge supervisors noted that there are heavier trucks on the road putting greater wear and tear on the infrastructure.

IV. Critical Concerns

Most commonly, counties feared that without larger budgets, their bridge and road infrastructure would continue to deteriorate. They often felt that Initiative 105 was a significant factor in their inability to fund improvements. For example, in Teton County, available funding for bridges has been cut nearly in half (for the same number of bridges). In addition, school equalization has redistributed oil revenues so that they are not necessarily recognized in the county they were generated. Counties have inadequate manpower and equipment to meet the need. The majority noted that they are operating with half the staff that they had in 1986. Most felt that they were woefully under funded. Many felt that their budget could easily be doubled to meet the current need for bridge and road repair and construction. In Cascade County, \$1,000 from all sources is available for each mile of county road while the actual cost was two to three times that for maintenance. A few noted that they felt that the gas tax was inequitably distributed. They generally agreed that an adequate maintenance program would eliminate the need for many major projects. Many expressed concern over increasing road and bridge wear and tear due to increased speed limits and heavier trucks. Those counties which are experiencing residential growth outside city limits, stressed that the infrastructure was inadequate to deal with increased traffic. A number of counties noted that hauling gravel long distances was particularly devastating to road budgets.

In addition to providing information regarding financing alternatives, county officials look to a manual like this to assist in setting priorities, scheduling projects to fit with funding cycles, materials recycling and legislative issues. Some also felt that additional public education was needed to help taxpayers understand the issues associated with residential growth and transportation needs.

V. Other Issues

Many county personnel noted that there is quite a large discrepancy between road and bridge budgets between incorporated cities and towns and the rest of the county. One road supervisor noted that the county is about \$3.00 per hour behind the city in wages paid to public works employees.

Hill and Ravalli Counties both mentioned increasing concerns about liability issues regarding bridge and road safety.

Appendix B

Test County Component Description

I. Introduction

The development of this manual relied in part on information gleaned from a closer look at a single county in Montana. The use of the test county enabled us to more easily develop and test the methodologies presented in this document, and provided specific examples that we could use in illustrating various aspects of bridge and road planning. While we recognize that a single county can not serve as a "model" for the entire state, working with county commissioners, road personnel and area residents provides invaluable insights from those most familiar with road and bridge infrastructure.

II. Test County Approach

Teton County was selected by the Department of Commerce to be used as the test county. The county was visited three times from October, 1996 to February, 1997. The first meeting included a visual inventory of bridges and roads, meetings with county commissioners and others, to get an initial feel for the community, its concerns and general perceptions about bridge/road issues. Existing data regarding bridge and road condition, equipment purchasing arrangements and current activities of the road department were provided by the County Road Supervisor, Tom Hardin. Information was also collected about the overall financial condition of the county, and general descriptive information and budgets for the road department and the general fund. This enabled the consultant to develop a general county profile as follows:

Teton County, population 6500, is located along the east slope of the Rocky Mountain Front and has a land area of 2,299 miles. Its taxable valuation is \$15,288,591 (Source: Montana Department of Revenue, 1994) and is classified as a Class Four County under Montana Statute. Approximately one third (33 percent) of its tax base is derived from Class 3 property (agricultural land), which is considerably higher than the state average of 8 percent. The next highest contributor to the tax base is residential and commercial property (Class 4) at 29 percent. The total number of mills levied by the county is 97.97 or approximately \$1.5 million annually.

The county has 1,543 miles of roads of which 120 are paved, and 119 off-system bridges over 20 feet and approximately 35 under 20 feet. Since 1986 the county has eliminated 146 bridges and replaced them with less expensive culverts. The county currently levies 18.89 mills for road construction. As a Class Four County they may levy up to 23 mills for roads without voter approval but are operating under the provisions of Initiative 105 which freezes property taxes at the 1986 level. As a county with a taxable valuation of less than \$20 million, they can levy up to 9 mills for bridges without voter approval, but are only levying 5 (including 2 mills for emergency bridge funding). The county receives \$18,000 per year from the U.S. Department of Defense for snow removal on roads that provide access to U.S. Air Force missile silos, an annual gas tax allocation of \$108,517 (\$67.35 per mile) and \$77,900 in PILT funds (Payment in Lieu of

Taxes). The total road department budget is \$671,785 for 1996-97.

While the county has been able to maintain their roads at a reasonable level, the road supervisor estimates that currently 90 percent of its bridges are facing reconstruction in the near future.

During the second visit, the site inventory of bridges in roads in Teton County was continued. A series of meetings were held to present the initial findings and to work with the community in setting overall priorities. Meetings were held in three locations in the County (Dutton, Fairfield and Choteau) where residents could voice their concerns about bridge and road infrastructure in the context of overall community concerns.

The third visit included a meeting with the Teton County Commissioners, staff and 15 interested residents to provide an opportunity for the consultants to present an overview of the bridge and road manual contents as well as some suggested ways to address the most pressing bridge and road concerns.

Appendix C

Funding Sources

I. Introduction

This appendix provides information on a variety of local and outside funding sources that are available to counties for the funding of bridge and road needs. It includes those publicly supported programs that have expressly included transportation infrastructure as eligible for funding. In certain cases, other programs, that are not listed here, may provide funding for bridges and roads as part of other eligible activities. For example, bridges and roads may benefit from programs that provide project funding for reclamation, wildlife management, historic preservation, or recreation. Private foundation sources have not been included. In most cases, private foundations do not award grants to government entities. However, there may be instances where private foundation funds can be incorporated into a financing scheme. For example, an American Indian community may be eligible for private foundation funding to construct a bridge in conjunction with an economic development project. However, in general, funding for county maintained bridges and roads comes from public sources at the local, state and federal levels. A chart summarizing the various funding sources can be found at the end of this appendix.

II. Local Financing Tools

This section describes funds and funding sources that are available to counties at the local level to finance bridge and road infrastructure under Montana statute. Funding methods, such as local option taxes, improvement districts, tax increment financing and other types of bonds, enable the local beneficiaries to participate in the funding of bridge and road infrastructure. Included are those methodologies that are commonly used and also those that are tapped less frequently. It should be noted that the survey of counties conducted in July and August of 1996 indicated that where funds can be applied to either bridges or roads, roads have often been given preference. Bridge needs, which may be as critical as road requirements, are generally not as obvious, and as a result, often do not receive attention and funding priority until it is too late. The various local funding sources and strategies include the following:

A. Bridge and Road Mills (Property Taxes)

County budget revenues are based on a "mill" which is equal to one/one thousandth of the county taxable valuation. The county sets the number of mills to be levied based on county needs but subject to overall taxation limitations set by Montana State statute. Each property owner pays taxes in an amount equal to his or her share of the taxable valuation of the property multiplied by the number of mills levied. Road mills are based on the county's taxable value exclusive of incorporated areas while bridge mills are based on county taxable value inclusive of all incorporated and unincorporated areas. According to 7-14-2201, MCA, each board of county commissioners shall maintain all public bridges (in the entire county) other than those maintained by the Department of Transportation.

The number of mills, which can be set for county road budgets, is further determined by each county's classification (1 through 7) which is determined by its taxable valuation as provided for in 7-1-2111, MCA. In 7-14-2501, MCA, Financial Management of County Bridges and Roads, Counties that are classified as 1,2, or 3 may levy up to 20 mills for roads. Other classes of counties (4-7) may levy up to 23 mills. Counties may levy 8 mills for bridges (7-14-2502, MCA) and an additional mill if the county's taxable valuation is less than \$20 million. For those counties with taxable valuations between \$20 and \$40 million, an additional 2 mills may be levied. Counties are allowed to levy an additional 10 mills for constructing highways and bridges but this levy is subject to voter approval (7-14-2504, MCA).

The number of mills a county can levy has been restricted under the provisions of sections 15-10-402 and 15-10-420, MCA. Therefore, despite the taxing authority described above, counties *may not* be able to levy the number of mills that are authorized under Montana code for bridge and road infrastructure.

B. Depreciation Reserve Funds (bridges, roads and equipment)

Montana law permits counties to establish Road and Bridge Depreciation Funds for acquisition, replacement of property, capital improvements and equipment necessary to maintain and improve county road and bridge facilities and services (7-14-2506, MCA). The depreciation fund may not exceed \$200,000 and must be invested according to Montana law. Amounts that exceed operation requirements may be allocated to this fund over time. This strategy provides a way in which counties can finance major bridge and road work through a minimal appropriation each year. It enables counties to anticipate bridge and road needs over time with respect to the expected useful life rather than being confronted with a crisis. This technique is fiscally sound and may be more politically palatable in that tax payers are not asked to foot the bill for road or bridge repair or reconstruction all at once through increased assessments or bond debt payments.

C. County CIP Fund (bridges, road, equipment)

Under 7-6-2219, 20, 21, MCA, the governing body of any county in Montana may establish a capital improvement fund for the replacement and acquisition of property, plant, or equipment costing in excess of \$5,000 and with a life expectancy of five years or more. In order to create a capital improvement fund, the county must have a capital improvement program, which has been formally adopted by the local governing body. Money for the fund is to be derived from the multiple levies authorized by statute and appropriated to the capital improvement fund. The amount in the CIP fund may not exceed 10 percent of the money derived from any one levy. The fund may not exceed, at any time, a competent engineering estimate of the cost of the adopted capital improvement program and must be expended within a ten-year period.

D. Life Cycle Costing for Road Equipment (equipment)

In addition to depreciation funds, counties can choose to participate in lease-purchase agreements with equipment companies with "buy back" options. Under lease-purchase agreements, the county "rents" road equipment. When the rent payments equal the

purchase price, the county becomes the owner. During the rental period, the equipment company provides regular maintenance. When road equipment requires replacement, buy back options enable a county to sell equipment back to the equipment supplier and enter into a new lease-purchase agreement. Lease-purchase agreements can enable a county to keep equipment costs constant and down time for repairs at a minimum. This approach looks at the cost of operating equipment on a per hour basis over the life of the equipment, rather than a one-time purchase price. Teton County, for example, currently takes part in such a program for its road graders. As their equipment supplier provides maintenance on a regular schedule, county crews are able to spend more time grading county roads and less time repairing machinery.

E. Gas Tax Allocation (roads)

Under 15-70-101, MCA, each county receives a portion of the statewide gas tax. The amount allocated to each county is based on four factors including rural road miles, rural population, land area and the value of rural land, exclusive of incorporated areas. Funds may be used for roads. Gas Tax dollars are used to address secondary roads needs within each of the five state districts. Projects are selected jointly by the Montana Department of Transportation and in consultation with local county governments. Additional information on this program is provided in the section on outside funding sources (see the next section).

F. PILT Payments and Timber Receipts (bridges and roads)

Federal public land management agencies are not subject to taxation. However, counties with federal lands are compensated for the resultant loss of tax revenue by Payment in Lieu of Tax or "PILT" funds. Counties may allocate any portion of PILT fund for roads and bridges. Counties also receive a percentage of receipts from U.S. Forest Service timber harvests of which 40 percent is allocated to schools and 60 percent to roads and bridges. The amount of PILT funds a county receives is reduced somewhat when timber harvest receipts increase, so that the total amount which a county receives in PILT and timber receipts remains fairly constant over time.

G. Optional Motor Vehicle Tax (bridges and roads)

Under state law, counties have the option of imposing a .7 percent tax on motor vehicles under 61-3-537, MCA if it is approved by the electorate. Of the amount collected, 50 percent is allocated to the county and the remaining 50 percent is allocated to both the county and incorporated areas based on population. While district courts are given first priority for funding under this program, counties may use a portion of the funds for bridges and roads.

H. Local Option Motor Fuel Excise Tax (bridges and roads)

County governments may levy a motor fuel excise tax under 7-14-301, MCA. The tax, which cannot exceed 2 cents per gallon may be levied as the result of local initiative or by a resolution passed by the board of county commissioners. Funds may be used for the construction, reconstruction, maintenance, and repair of public streets and roads.

I. Oil and Gas Leases (bridges and roads)

Under 7-14-2505, MCA, counties may allocate 50 percent of those funds received from oil and gas leases and reserved royalty interest to the county road fund.

J. Debt Financing

Counties can make use of various kinds of debt financing to meet bridge and road needs. These include general obligation bonds, rural improvement district bonds and revenue bonds. Debt financing enables local governments to finance major infrastructure projects using future revenue from special assessments, user fees, and other forms of revenue. The county incurs various administrative costs in conjunction with issuing bonds. These costs include the retention of legal counsel and financial consultants, the establishment of reserve funds and the preparation of the prospectus and various required documents. These bonds provide tax free interest earnings to purchasers and are therefore subject to detailed scrutiny under both state and federal law. The citations in the Montana Code are listed below, for each type of bond described.

1. Rural Improvement Districts (bridges and roads)

The most common form of debt financing for transportation infrastructure is undertaken through the formation of rural improvement districts (RID) outside the limits of incorporated towns. Section 7-12-2102 and Section 7-12-4102, MCA, authorizes an RID for a number of purposes including paving, curbs and gutters, culverts, and bridges.

In a RID, the cost of the improvements are born by those property owners which are primarily benefiting from the improvement. Property owners pay an annual fee, which is included on their property tax statements to cover debt service for improvements and/or ongoing maintenance costs.

The creation of an RID can be initiated by the board of county commissioners or by the property owners. Although not required, property owners within the proposed district will often submit a petition to the county commissioners requesting that the district be created. Before any formal action is taken, either the county surveyor and/or a professional consultant prepare cost estimates. Cost estimates should be prepared carefully and include a range of costs that might be anticipated in association with undertaking the proposed construction or maintenance. Once the project has been defined and cost estimates prepared, the commissioners pass a Resolution of Intent to create the district. The resolution informs the property owners of the size of the district, the nature of the improvements, the project engineer, cost estimates, method of assessment and duration (7-12-2103, MCA). The affected property owners are given due notice of the intent to create the district and opportunity to protest. If less than 50 percent of those property owners protest, the county may proceed with the creation of the RID. More detailed information on the creation of special districts is provided in two Montana Department of Commerce publications, entitled *Rural Special Improvement District Handbook*, and *Special Improvement District Handbook, Second Edition*, both published in May of 1986.

2. Local Improvement Districts for Roads (roads)

Upon receipt of a proper petition, the board of county commissioners may create a local improvement district (LID) for roads, which can fund the survey, construction, opening and improvements of roads (7-14-2701, MCA). The petition must be presented by owners of 2/3 of the lineal feet of land fronting the proposed or existing road or by 2/3 of the residents of the proposed road district. The county commissioners can choose to share the costs with the property owners under 7-14-2733, MCA. This particular provision is available for roads only and is specific to county governments.

3. General Obligation Bonds (bridges and roads)

Counties may issue general obligation bonds for the financing of bridge and road infrastructure. General obligation bonds are backed by the full faith and credit of the county and must be approved by the voters in an election. As such, they are not subject to the taxing limitation contained in 15-10-402, MCA. General obligation bonds are generally payable from ad valorem taxes (based on the value of property) and expressed in mills. General obligation bonds are attractive to bond buyers because they have voter approval and are not as vulnerable to fluctuations in revenue. Counties are assigned a bond debt limit based on a percentage of taxable valuation. General obligation bonds must fall within this limit. Under 7-14-2205 and 7-14-2521, MCA, counties may issue bonds upon the full faith and credit of the county for the construction or improvement of county roads, state highways and bridges. It is important to note that under 7-14-2205, MCA, if the county will be undertaking the construction of a bridge in any city or town, and must incur debt of \$10,000 or more to complete the project, it must do so by issuing general obligation bonds after approval by a vote of the qualified electors of the county on the question of whether the bridge is to be constructed and paid for by the county. County commissions are often reluctant to consider general obligation bonds because they fear that county residents will vote down the bond, particularly if they see only a segment of the county benefiting from the improvement. One approach to this problem might be to package a number of bridges, strategically located throughout the county, in one construction project to gain support from voters county-wide.

4. Revenue Bonds (bridges and roads)

Under 7-7-2501, MCA, a county may issue revenue bonds to finance any project or activity authorized including the construction of bridges and roads. Revenue bonds are retired through the payment of earnings including user fees incurred by a public enterprise, such as toll bridges or toll roads. Revenue bonds have no claim on the county's taxable resources, unless specified (through a special guarantee, for example). As such, they are not subject to the taxing limitation contained in 15-110-402, MCA. Industrial revenue bonds enable the financing of bridge and road infrastructure, which benefits private industrial concerns. Lease payments are made by the industry to the local government to service bond debt. Bonds may be issued in the form of general obligation bonds, revenue bonds or a combination. In reality however, the use of revenue bonds for county bridge and road projects is not very feasible, since these projects rarely provide any source of long-term revenue to cover debt service.

K. Tax Increment Financing (municipalities only) (bridges and roads)

Under the Montana Urban Renewal Law (7-15-4201, MCA), communities may establish tax increment districts for the purposes of revitalizing blighted neighborhoods, central business districts and infrastructure deficient industrial areas. Tax increment financing simply means that new property tax dollars resulting from increases in the market value of real property may be directed to the area where the real property is located. The base property tax (before any improvements to real property) continues to be distributed to the local government and school districts. However, tax dollars that accrue from increases in property values (from rehabilitation, new construction, etc.) are available for reinvestment. A tax increment program is authorized for 15 years or longer if the tax increment revenue is pledged to the payment of tax increment bonds. A municipality must identify the specific geographic area where the program will be implemented. Funds may be used to finance roads and bridges within tax increment areas. In the case of industrial infrastructure district, funds may also be used to connect districts to other resources. If the improvement will benefit industrial development within the tax increment district, funds may be used to finance bridges and roads, which include portions outside the increment district. Tax increment programs depend on substantial investment in property but can work in rural communities that are experiencing some growth.

The use of tax increment financing is restricted to "municipalities" or incorporated areas including consolidated city-county governments. However, as counties are responsible for all off-system bridges, including those that are located in cities and towns, tax increment financing may offer some local funding for bridge repair or reconstruction if the city or town council, or urban renewal agency, approves the use of tax increment funds for bridge improvements. In addition, if a bridge is historic or offers additional recreational opportunities (e.g. for pedestrian or cyclists), the city might provide tax increment funds for improvements as part of their community revitalization program.

L. Impact Fees (bridges and roads)

A number of counties have contemplated the use of impact fees for the construction and upgrading of roads and bridges in association with new subdivisions. The Montana Subdivision and Platting Act, 76-3-510, MCA provides for such fees to be assessed as long as they are *proportional* to the impact created. The statute states, "A local government may require a subdivider to pay or guarantee payment for part or all of the costs extending capital facilities related to public health and safety, including but not limited to public roads. The costs must reasonably reflect the suspected impacts directly attributable to the subdivision." The developer must be provided with information indicating how the fees will be spent. Fees may go for construction, replacement and upgrades but not for regular operations and maintenance.

The county zoning enabling act (76-2-201 et seq., MCA) may provide some basis for the charging of impact fees. Under 76-2-203, MCA, a county may establish zoning regulations designed to, among other things, "lessen congestion in the streets; to secure safety from fire, panic, and other danger; to facilitate the adequate provision of transportation...and other public requirements." Therefore a county, in adopting and administering its zoning regulations, may consider the impact new developments will

have on roads and bridges. It would seem that it may also require a developer to pay an impact fee to cover the cost of providing the transportation infrastructure necessary to serve the development. Any such fee would have to be roughly proportional to the additional transportation needs represented by the new development. Also, the fees could be used only for construction or upgrading of facilities and not for operations and maintenance.

M. Voluntary Programs (bridges and roads)

In some cases, homeowner associations, business groups or other property owners may finance bridge and road improvements on a voluntary basis. In Gallatin County, for example, private associations have raised funds for road improvement and then contracted with the county to undertake the work. In some instances, the county and the association have shared the development costs.

(NOTE: The information provided on the following funding sources is current as of the date of this appendix. However, the programs and funding sources listed are subject to change in both their application procedures and funds available. To ensure that specific funds are still available, call the program in question.)

III. Montana Department of Transportation (MDT) Funding Sources

The Montana Department of Transportation (MDT) administers a number of programs that are funded from state and federal sources. Federal-aid funds are distributed under state statute (60-2-126, MCA) for use on Secondary and Urban System routes on a priority basis. Urban System funds are distributed based on a per-capita distribution to urban areas of greater than 5,000 in population and Secondary System funds are distributed by a formula which includes consideration of rural road mileage, rural population, bridge square footage, and land area. In most cases, the funds are administered by the MDT at the State level and MDT staff work with county governments in the planning and design of projects, whatever the specific funding source.

Each year, in accordance with 60-2-127, MCA, the Montana Transportation Commission allocates a portion of available federal-aid highway funds for construction purposes for projects located on:

- a) the national highway system;
- b) the primary highway system;
- c) the secondary highway system;
- d) the urban highway system; and
- e) state highways.

Information is presented here on the secondary and urban highway systems, as the allocation of funding and program eligibility are of greatest concern to county governments. The following information is taken from the *Financing Montana's Federal-*

Aid Highways, prepared by the MDT Transportation Planning Division, March 6, 1996, and the Montana Code Annotated. For more information, call 406-444-6110 or write the MDT at 2701 Prospect, Box 201001, Helena, Montana 59620-1001.

A. Secondary Road Program (bridges and roads)

The Secondary Highway System is defined under 6-2-125, MCA as those highways that have been functionally classified by the MDT as either minor arterials or major collectors and that have been selected by the Montana Transportation Commission in cooperation with the boards of county commissioners, to be placed on the secondary highway system.

- ***Authorization***

The 1991 Federal transportation bill, the Intermodal Surface Transportation Efficiency Act or "ISTEA", and continued in the 1998 TEA-21, provides funding in two major categories: the National Highway System and the Surface Transportation Program. Surface Transportation program funds are in turn allocated by state statute to the state designated highway systems and the secondary highway systems. Under 60-2-127, MCA, the Montana Transportation Commission apportions these federal funds.

- ***Allocations and Matching Requirements***

Federal funds for secondary highways must be matched by non-federal funds on a 86.58 percent (federal) to 13.42 percent (non-federal) basis. Normally, the match on these funds is from the state. Funds are apportioned to MDT financial districts based on a formula, which takes into account the land area, population, road mileage and bridge square footage. For the total funds available 65 percent are allocated for capital construction projects and 35 percent will be allocated to pavement preservation. The Montana Transportation Commission may use funds for on-system bridges and secondary roads subject to approval.

- ***Eligibility and Planning Considerations***

The Montana Transportation Commission consults with the board of county commissioners of the county in which a highway is located when establishing priorities and when selecting and designating segments on the Secondary Highway System for construction and reconstruction. Projects must be included in the Statewide Transportation Improvement Program (STIP), which is updated every year in September. The state does provide design and planning assistance, but encourages counties to retain the services of a consultant to develop secondary road projects in order to provide greater local authority in planning and implementation. The county, in this case, acts as contracting agency, overseeing the consultant selection and overall project development. This process transfers the authority and responsibility for the project to the government entity closest to and most interested in the work.

B. Urban Highway System (bridges and roads)

The Urban Highway System is described under 60-2-125, MCA, as those highways and streets that are in and *near* incorporated cities with populations of over 5,000 and within

urban boundaries established by the MDT, that have been functionally classified as either urban arterials or collectors, and that have been selected by the Montana Transportation Commission, in cooperation with local government authorities, to be placed on the Urban Highway System.

- ***Authorization***

Under 60-3-211, MCA, the MDT apportions the federal-aid highway funds allocated for the urban highway system to the cities in the state with populations of over 5,000.

"Urban population" is defined as population within the incorporated limits of cities of over 5,000, and that population within unincorporated urban fringe areas delineated and reported in the latest federal census.

- ***Allocations and Matching Requirements***

Funds are distributed based on a ratio of population in each city to the total urban population, statewide. When necessary, an urban area may exceed the amount apportioned for construction projects. However, the excess amount is then deducted from future apportionments to that city. The federal/state match follows the same proportions as the Secondary Highways System.

- ***Eligibility and Planning Considerations***

The Montana Transportation Commission consults with the appropriate local government authorities prior to designating a highway or street to be placed on the Urban Highway System, and when establishing priorities and selecting and designating segments on the Urban Highway System for construction and reconstruction. In those areas where the urban area extends outside of the incorporated limits, the Commission (and the MDT) consult with the county government in identifying projects and setting priorities. Because the Urban Highway System includes transportation infrastructure that crosses the line between incorporated and unincorporated areas, it is important that city and county governments work together to identify and address urban highway needs. Consideration of cooperative efforts between city and county governments to address urban highways (roads and bridges) should be incorporated into the planning and implementation of the county CIP as appropriate.

C. Pavement Preservation (35 percent of the total federal & state funds will be allocated to pavement preservation for on-system secondary roads)

- ***Authorization***

Pavements Preservation funds are currently used to extend the life of existing paved routes that are on the secondary system. Historically, these funds have been available for the rehabilitation and replacement of off-system bridges, however, Pavement Preservation dollars are not currently available for bridges.

- ***Allocations and Matching Requirements***

Monies for this program come from the State Highway Special Revenue Account, which in turn is funded by the State Fuel Tax and other fees. The Pavement Preservation program funds are distributed to five financial districts: Missoula, Butte, Great Fall,

Glendive and Billings in an amount reflecting the previous year's expenditures. Counties within each district may receive funds.

- ***Eligibility and Planning Considerations***

All Pavement Preservation projects must be approved by the Montana Transportation Commission and included in the STIP, and therefore, should be nominated at least two years before contracts are to be let. District personnel generally design projects.

Pavement Preservation project priorities are set with respect to Pavement Management Data. These priorities are established in consultation with county commissioners and then further refined by District personnel and the MDT Secondary Road Engineer. District priorities consider the needs of all the counties in that district and the fair division of projects among all counties in the District based on funding levels.

D. Bridge Replacement and Rehabilitation Program (bridges)

- ***Authorization***

The federal "Highway Bridge Replacement and Rehabilitation Program" (HBRRP) enables states to replace or rehabilitate bridges that are unsafe because of structural deficiencies, physical deterioration or functional obsolescence.

- ***Allocations and Matching Requirements***

For *off-system bridges*, the HBRRP provides for 80 percent federal participation to be matched by 20 percent from the state. In Montana, of the available funds, 35 percent are earmarked for off-system bridges, the ***maximum*** amount allowed under federal law (15 percent is required under federal regulations and the states have the option of appropriating an additional 20 percent). Not less than 65 percent or more than 85 percent of a state apportionment is available for those bridges *on-system*, which include bridges on the secondary system. Funds are allocated to each of the five financial districts based on need.

- ***Eligibility and Planning Considerations***

Eligibility is determined on the basis of a field inventory of the state's bridges, carried out in a two-year cycle by MDT. A structural inventory and appraisal is completed for each structure. This information is used to calculate the Sufficiency Rating that determines whether the bridge is structurally deficient, functionally obsolete or sufficient. Structurally deficient bridges are those with a rating of less than 50 percent. A functionally obsolete bridge is generally defined as one having a sufficiency rating of 50 to 80 percent. A bridge with a sufficiency rating of greater than 80 percent does not qualify for federal funding.

The county commissioners with respect to the structural inventory set priorities for off-system bridge projects. The state Secondary Road Engineer and the MDT Bridge Bureau select projects. Off-system bridge projects must be included in the STIP and approved by the Montana Transportation Commission. Projects are then submitted by MDT staff for federal funding approval. Upon receipt of federal funding authorization,

the MDT Bridge Bureau designs the majority of off-system bridge projects, with only a minimal number of projects designed by private consultants.

Upon request, the Bridge Bureau at MDT will provide a list of eligible bridges for each county. From this list, the counties can rank the bridges in their county. Using the county list of priorities and the individual bridge inspection reports, the Secondary Roads Engineer, along with the Bridge Bureau, selects projects for funding (usually a five to six year time frame). The selection process is based on a point system, in consideration of county priority, and the elements of the sufficiency rating for each bridge. The process of on-system bridges is similar. However, priorities are set by each MDT District, rather than by counties.

E. Forest Highway Funds (bridges and roads)

- ***Authorization***

The Forest Highway Program is authorized under the Federal Lands Highway Program, which provides 100 percent federal funding for Indian Reservation Roads, Parkways and Park Roads, and Public Lands Highways.

- ***Allocations and Matching Requirements***

Two-thirds of the funds allocated for the Public Lands Highway Program are dedicated to Forest Highways and the remainder is discretionary.

- ***Eligibility and Planning Considerations***

Forest Highways are proposed for inclusion in the system by the MDT and the U.S. Forest Service with additional proposals coming from the counties. Routes are designated by the Federal Highway Administration in conjunction with the Forest Service and the State. The criteria for a route to be on the Forest Highway System are:

- Development and utilization of National Forest Service renewable resources;
- Enhance economic development at a local, regional or national level;
- Traffic;
- Serves preponderance of Forest Service generated traffic; and
- Continuity of transportation network serving Forest Service and dependent communities.

Eligible activities include, but are not limited to:

- Planning, research, engineering and construction;
- Transportation planning for programs to enhance tourism and recreational development; and
- Construction and reconstruction of roadside rest areas (including sanitary and water facilities).

Eligible improvements include reconstruction, engineered overlays and bridges. Maintenance improvements are not eligible. Projects that occur on Primary, Secondary or National system roads must have Federal Transportation Commission approval. Projects are designed and constructed under the auspices of the Western Federal Land Highway Division of the Federal Highway Administration.

Public Lands funds are discretionary in nature and allocated on the basis of need for specific projects that are proposed by the States and which must compete for funding with other projects on a nationwide basis. Typically, many more projects are submitted for consideration than can be selected within budgetary constraints. Local governments are encouraged to work closely with the MDT in planning for these projects, in order to present projects that are well documented as to their eligibility for funding.

F. Federal Hazard Elimination Program (STPHS) (bridges and roads)

- ***Authorization***

The Federal Hazard Elimination Program (STPHS) funds apply to all roads except the National Highway System-Interstate. Funding is allocated on a priority system, based on a benefit/cost analysis. The State (MDT) tries to get the highest returns on the dollars invested in safety improvements, to eliminate the most critical hazards.

- ***Allocations and Matching Requirements***

The funding for any corrective action under this program is 90 percent federal and 10 percent state/local participation.

- ***Eligibility and Planning Considerations***

To be eligible, a county must be a regular participant in reporting accidents to the MDT Transportation Information System (TIS). The proposed improvement must be on the county's hazard priority list and it must not fall under regular maintenance activities. The county submits information to MDT regarding accident data and trends, traffic information and proposed improvements. All safety improvements are included in an overall statewide ranking and priority listing. Depending on the funding level, the projects with the highest benefit/cost ratios are funded under this program to eliminate hazards.

G. Transportation Enhancements (pedestrian/bicycle, landscaping, etc.)

- ***Authorization***

Transportation enhancements are provided for under ISTEA and TEA-21, which allocates 10 percent of the Surface Transportation Program monies awarded to each state for transportation enhancements.

- ***Allocations and Matching Requirements***

In Montana, enhancement funds are made available to communities under the Community Transportation Enhancement Program (CTEP) administered by MDT. The

MDT has set aside these funds for all counties and cities that are 1st, 2nd, and 3rd class cities, and tribal governments. From 1992 through 2003, the annual allocation has been approximately \$4.5 million. Local governments are responsible for providing the required 13 percent of project costs as non-federal match for their transportation enhancement projects. Under certain conditions, counties may use services in kind as part of their required match. Total project costs is suggested to be at least \$10,000.

- ***Eligibility and Planning Considerations***

In order to receive funding, transportation enhancement projects must be included in the STIP. Eligible CTEP categories include:

- Pedestrian and bicycle facilities
- Historic preservation
- Acquisition of scenic easements and historic or scenic sites
- Archaeological planning and research
- Mitigation of water pollution due to highway runoff or reduce vehicle-caused wildlife mortality while maintaining habitat connectivity
- Scenic or historic highway programs including provisions of tourist and welcome center facilities
- Landscaping and other scenic beautification
- Preservation of abandoned railway corridors (including the conversion and use for bicycle or pedestrian trails)
- Rehabilitation and operation of historic transportation buildings, structures or facilities (including railroads)
- Control and removal of outdoor advertising
- Establishment of transportation museums
- Provisions of safety and educational activities for pedestrians and bicyclists

Projects addressing these categories and that are linked to the transportation system by proximity, function or impact, and where required, meet the "historic" criteria, may be eligible for enhancement funding. For example, where an historic bridge must be replaced because of structural deficiencies, enhancement funds might be used to preserve the original bridge as part of an interpretive trail.

Projects must be submitted by the local government to the MDT, even when the project has been developed by another organization or interest group. Project proposals must include evidence of public involvement in the identification and ranking of enhancement projects. Local governments are encouraged to use their planning boards, where they exist, for the facilitation of public participation; or a special enhancement committee. The MDT staff reviews each project proposal for completeness and eligibility and submits them to the Transportation Commission and the Federal Highway Administration for approval. Funds were expected to be available each year for six years. Reauthorization will occur in 2004.

IV. Other State and Federal Funding Sources

A. Treasure State Endowment Program ~ Montana Department of Commerce (bridges)

- ***Authorization***

The Montana Treasure State Endowment Program (TSEP) is a state-funded program, authorized under 90-6-701 through 710, MCA, and is administered by the Montana Department of Commerce (MDOC). It is designed to assist local governments in financing capital improvements to public facilities including bridges (but not roads). Funds are derived from the Montana coal severance tax and made available to local governments as matching grants, loans and grant/loan combinations. TSEP also provides matching grants of up to \$15,000 to local governments for preliminary engineering study costs.

TSEP funds may not be used for annual operation and maintenance; the purchase of non-permanent furnishings; or for refinancing existing debt, except when required in conjunction with the financing of a new TSEP project.

- ***Allocations and Matching Requirements***

Approximately \$14 million was available to award for grants during the 2003 biennium, and this amount grows approximately \$2 to \$3 million each biennium. Grant requests cannot exceed \$500,000 and the county must typically provide a dollar for dollar match that can include other grant funds. Matching funds can be public or private funds provided by a TSEP applicant to directly support the cost of eligible project activities. There are a number of ways in which local governments can provide matching funds for bridge projects. Eligible types of matching funds include:

- local general funds or other cash;
- proceeds from the sale of general obligation, revenue, special assessment or other bonds;
- entitlement or formula-based federal or state funds such as federal highway funds or payments in lieu of taxes;
- loan or grant funds from a state or federal program (including TSEP loans);
- funds expended for engineering studies, reports, and plans, or other reasonable expenses expended for the preparation of the application, directly related to the proposed project during the period 24 months prior to the TSEP application deadline;
- funds expended after the TSEP application deadline, but before being approved by the Legislature, for project management, final engineering design, and other reasonable expenses necessary to prepare the project as proposed in the TSEP application for the construction phase;
- the value of land or materials provided by the applicant, if appraised within a two-year period preceding the application deadline. The appraisal must be:
 - 1) an impartially written statement that adequately describes the land or materials, and states an opinion of defined value as of a specific date;
 - 2) supported by an analysis of relevant market information; and

- 3) prepared by a qualified appraiser independent from the applicant.
- the value of labor performed by the applicant's employees on the proposed project, after the TSEP project has been approved for funding and a TSEP contract has been signed, as long as the employee is paid at his or her standard hourly rate of pay and the time worked is adequately documented; and
- the value of machinery used in the process of constructing the project that is owned (or leased) and operated by the applicant. The value of the use of the machinery will be determined using the Federal Emergency Management Agency (FEMA) equipment rate schedules.

A county should evaluate each of these mechanisms regarding its potential use for the proposed project. In addition, the county should evaluate whether it has allocated the maximum amount of tax revenues to the bridge fund. In addition to local sources, counties should evaluate other potential outside grant and loan sources. A thorough analysis of the feasibility of using these various funding mechanisms is a critical component in developing a proposal to TSEP.

- ***Eligibility and Planning Considerations***

Eligible applicants include incorporated cities and towns, counties, consolidated governments and county or multi-county water, sewer, or solid waste districts, and tribal governments (includes any federally recognized Indian tribe within the State of Montana.) Counties may form partnerships with other eligible applicants to provide the most appropriate and cost effective solution. Such partnerships would be particularly useful for bridge projects that often involve a number of jurisdictions. Bridge projects submitted to TSEP can be more than one bridge.

Bridge projects can effectively compete for funding under a number of the criteria used to evaluate and rank projects. The federal government has identified very specific standards under which bridges are evaluated. Issues related to safety can be well defined and easily documented. **Projects that include bridges with a sufficiency rating of 50 or less will be the most competitive.** MDT routinely inspects bridges that are 20 feet or longer in length. For bridges not inspected by MDT, the county will need to obtain the services of an engineer that is trained and qualified to inspect bridges. In certain circumstances, state bridge personnel at the MDT may be able to assist in providing an inspection as a service to the county. Inquiries to the MDT should be made as early as possible so that an inspection can be scheduled in time for TSEP application submittal. **TSEP has specific requirements for what should be included in the preliminary engineering study. A properly completed preliminary engineering report is critical to being competitive and ultimately funded.** Counties that have adopted capital improvement plans for their road and bridge improvements and associated costs will also be more competitive.

Applicants will also need to demonstrate that the county has taken all reasonable steps to fund bridge projects. During process of ranking applications, a financial analysis is completed in order to evaluate relative financial need. MDOC looks at the current efforts by applicants to finance their bridge systems. The financial analysis for bridge

applicants is primarily based on two indicators; however, additional information will also be used to determine the score provided on the financial analysis. The primary financial indicator used to measure financial need looks at the bridge levy relative to the county's median household income (MHI). If the bridge levy is below the statewide median of .04% of MHI, MDOC will also look at the total levy relative to the county's MHI. If the bridge levy is below the statewide median, MDOC will also look at a second indicator that evaluates changes in the county's ability to levy taxes. **In order to be competitive applicant's typically need to demonstrate that the county's bridge levy is equal to no less than .04% of the county's MHI.**

X *Application Information*

Project proposals are submitted to the MDOC every two years. Applications are due in May of the year prior to the legislature meeting. Applications are ranked based on seven statutory priorities:

- 1) projects that solve urgent and serious public health or safety problems, or that enable local governments to meet state or federal health or safety standards;
- 2) projects that reflect greater need for financial assistance than other projects;
- 3) projects that incorporate appropriate, cost-effective technical design that provide thorough, long term solutions to community public facility needs;
- 4) projects that reflect substantial past efforts to ensure sound, effective long-term planning and management of public facilities and that attempt to resolve the infrastructure problem with local resources;
- 5) projects that enable local governments to obtain funds from sources other than TSEP;
- 6) projects that provide long term, full time job opportunities for Montanans, that provide public facilities necessary for the expansion of a business that has a high potential for financial success, or that maintain the tax base or encourage expansion of the tax base; and
- 7) projects that are high local priorities and have strong community support.

The Governor reviews the recommendations prepared by the MDOC staff and submits recommendations to the Legislature, which makes the final decision on funding awards. Applications for preliminary engineering grants can be submitted throughout the biennium and are awarded on a first-come first served basis.

For more information on the Treasure State Endowment Program, contact the TSEP staff at 406-444-2400 or write to the Treasure State Endowment Program, Montana Department of Commerce, PO Box 200523, 1424 Ninth Avenue, Helena, MT 59620-0523.

B. The Montana Intercap Program ~ Montana Board of Investments (bridges and roads)

• *Authorization*

The Montana Intercap program is administered by the Montana Board of Investments and provides loans to local governments for a variety of public projects including roads

and bridges.

- ***Allocations and Matching Requirements***

Up to \$500,000 can be made available for each project. The program provides loans at a variable rate plus a one percent loan origination fee on loans over one year and for a term of 5 or 10 years depending on the borrower's legal authority. Short-term loans of less than a year are also available. Interest and principal payments are due bi-annually (February 15 and August 15 of each year). Loans may be pre-paid without penalty with 30 days notice. Types of financing include installment purchase loans, general fund loans, general obligation bonds, revenue bonds and special improvement district and rural improvement district bonds. Gas tax revenues may not be used to service debt. Projects that will use rural improvement district payments to cover the annual debt are limited to a total loan of \$300,000. Inter-cap funds may be used in association with other grant and loan programs as well as local sources.

- ***Eligibility and Planning Considerations***

Bridge and road projects are among the public facility projects that are eligible for Inter-cap financing. Loans can also be used to cover ***preliminary engineering costs*** in association with a bridge or road project under the same terms as described above. Preliminary engineering studies are those that are conducted by a professional consulting engineer. Funds may not be used for studies conducted by county personnel. Many funding programs, including those provided through MDT and the Treasure State Endowment Program require preliminary engineering studies for funding applications. Inter-cap loan funds can offer a county a reasonable alternative for financing these engineering studies.

- ***Application Information***

Monies are continuously available and applications are accepted at any time. For more information, contact the Montana Board of Investments at 406-444-0001 or in writing at 2401 Colonial Dr., PO Box 200126-0126, Helena, MT 59620

C. Community Development Block Grants ~ Montana Department of Commerce
(bridges and roads)

- ***Authorization***

Montana's Community Development Block Grant (CDBG) Program is a federally-funded competitive grant program designed to help communities of less than 50,000, and is aimed at benefiting low and moderate income persons. Grants are administered by the Montana Department of Commerce (MDOC) and awarded in three categories including economic development, housing and community revitalization, and public facilities. Bridge and road projects may receive assistance under the public facilities and economic development categories ***under limited circumstances*** described below.

- ***Allocations and Matching Requirements***

CDBG grant awards for public facilities projects may not exceed \$500,000 and are most often used in combination with other federal, state or local funds to make public

improvements. The program requires that applicants provide at least 25 percent local match.

- ***Eligibility and Planning Considerations***

Eligible applicants are limited to general-purpose local governments: cities and towns with less than 50,000 people and counties. Counties may apply for a project that will include activities within the jurisdiction of an incorporated city or town if the proposed activity will benefit all county residents. This is particularly relevant for bridges, given that the county is responsible for all off-system bridges both inside and outside of incorporated areas.

Each CDBG project proposal must demonstrate that at least 51 percent of the project's principal beneficiaries will be low and moderate income persons. Therefore, the area that is primarily served by the bridge or road in question must meet these requirements. Demonstrating that the improvements to a road or bridge will principally benefit low and moderate income persons could be difficult, and is unlikely to be competitive unless the bridge or road provides critical access for a low or moderate income neighborhood or community. If, for example, the proposed improvements will provide the only access for emergency assistance or access to other community services (such as schools or health care) and addresses a major public safety problem, the project may be more competitive.

Under the CDBG economic development category, roads and bridges or other public improvements may receive assistance when they are in support of a business or other economic development activity.

- ***Application Information***

Applications for public facilities funding are submitted to the MDOC late in May of each year. CDBG economic development project proposals are accepted at any time. Applicants should initially review potential projects with the MDOC staff to determine their eligibility under program guidelines. Proposed projects must be selected through a community-wide needs assessment, which incorporates a strong public participation component.

As in the TSEP program, the review of CDBG applications is undertaken in two steps. The first step ranks project applications based on program criteria. In the second step of review, applications are evaluated based upon the applicant's ability to borrow funds or otherwise finance the project without the use of CDBG funds.

For more information about the CDBG program, contact the Community Development office of the Montana Department of Commerce at 406-444-2488 or write to the Community Development Block Grant Program, Montana Department of Commerce, PO Box 200523, 1424 Ninth Avenue, Helena, MT 59620-0523.

D. Public Works Program ~ Economic Development Administration
(bridges and roads)

- ***Authorization***

The Economic Development Administration (EDA) is an agency within the U.S. Department of Commerce. The purpose of the Public Works Program is to assist communities with the funding of public works and development facilities that contribute to the creation or retention of private sector jobs and to the alleviation of unemployment and underemployment. Such assistance is designed to help communities achieve lasting improvement by stabilizing and diversifying local economies, and improving local living conditions and the economic environment of the area.

- ***Allocations and Matching Requirements***

Grants are awarded up to a participation level of 80 percent but the average EDA grant covers approximately 50 percent of project costs. Acceptable sources of match include cash, local general obligation or revenue bonds; Community Development Block Grants, TSEP grants and loans, entitlement funds, Rural Development loans; and other public and private financing, including donations.

- ***Eligibility and Planning Considerations***

Eligible road and bridge projects are those which are undertaken to facilitate economic development activities and are located in areas which meet EDA criteria regarding severe economically "distressed areas." Funding may not be used for non-industrial street/road construction or repair that is normally the responsibility of local government, county, or the Federal highway program. Projects *must* result in private sector job and business development in order to be considered for funding. Eligible applicants under this program include any state, or political subdivision thereof, Indian tribe (and other U.S. political entities), private or public nonprofit organization or association representing any redevelopment area if the project is within an EDA-designated redevelopment area. Redevelopment areas, other than those designated under the Public Works Impact Program must have a current EDA-approved Overall Economic Development Program (OEDP) in place.

- ***Application Information***

Applications are accepted on an annual-open cycle. The program does not set specific project funding limits. Call the Montana Economic Development Representative at 406-441-1175 or write to the Economic Development Administration, PO Box 10074, Federal Building, Helena, MT 59626 for more specific information.

E. Wood in Transportation (formerly the Timber Bridge) Program ~ U.S. Forest Service (bridges)

- ***Authorization***

The primary goal of the Wood in Transportation program is to help revitalize rural economies by improving rural transportation networks, expanding the range of markets for wood products, and creating service industries for wood bridge construction.

- ***Allocations and Matching Requirements***

Applicants must have 50 percent non-federal matching funds. Approximately \$400,000 is made available annually nation-wide. The funds are available in four categories of funding as follows (the maximum with contribution is \$150,000):

- Vehicular timber bridges
- Pedestrian/trail bridges
- Special Projects (retaining walls, sound barriers)
- Commercialization Projects

- ***Eligibility and Planning Considerations***

Projects must demonstrate the feasibility of modern timber structures as an economic solution. Vehicular timber bridge projects are those designed for normal highway use. Pedestrian/trail bridge projects are for structures that serve recreational trail activities. A commercialization project must have area-wide or regional significance -- as small as several counties or as large as several states. These larger projects are intended to foster the commercialization of modern timber bridge technology that results in the most cost-effective, structurally sound bridges being built and demonstrated. The program prefers that local labor pools, businesses and timber resources are used instead of resources from outside of Montana. Special projects are those that use innovative or experimental treatments, reduce infrastructure costs, or those that address wood in transportation uses and markets other than typical vehicular and pedestrian bridges.

- ***Application Information***

Applications are due each year in December and applicants are notified in early February as to whether their project has been accepted. For further information contact the Forest Service at 406-329-3147 or write to the Wood in Transportation Program, U.S. Forest Service, U.S. Department of Agriculture, 1800 Strand Ave., Missoula MT 59801.

F. Federal Emergency Management Agency (bridges and roads)

- ***Authorization***

In the event of emergencies that affect off system and local road and bridge infrastructure, the federal government provides relief through the Federal Emergency Management Agency (FEMA).

- ***Allocations and Matching Requirements***

FEMA dollars are for unanticipated needs that result from disasters and emergencies and are typically not included in a county's financial planning process.

- ***Eligibility and Planning Considerations***

FEMA personnel are dispatched to the site of the disaster and are responsible for addressing all elements of repair or replacement as required. They assess the damage, hire the necessary professional consultants, prepare engineering analyses, bid projects and manage contracts.

- ***Application Information***

For further information contact the FEMA regional office in Denver, Colorado. Phone: 303-235-4830. Address: Federal Emergency Management Agency, Denver Federal Center, Building 710, PO Box 52267, Denver, CO 80225.

G. Federal Highway Administration Emergency Relief (Federal-aid road or bridge)

- ***Authorization***

In the event of emergencies that affect on-system, state owned roads and bridges, the Federal Highway Administration (FHWA) provides relief through the Emergency Relief (ER) program. Funds are distributed through the ER program much like traditional highway funds in that the State's are reimbursed for their efforts in correcting emergency situations. The ER program provides for repair and restoration of highway facilities to pre-disaster conditions.

- ***Allocations and Matching Requirements***

ER dollars are for unanticipated needs resulting from floods, slides, and earthquakes, and other natural disasters. ER dollars cannot be expended for items considered to be "heavy maintenance," or work frequently performed by the state and county maintenance crews in repairing damage normally expected from seasonal and occasional unusual natural conditions

- ***Eligibility and Planning Considerations***

Federal, State, and County personnel are dispatched to the disaster area and are responsible for addressing all elements of repair as deemed necessary by the review team and approved by the FHWA. Eligible items include:

- Engineering and Right-of-Way,
- Detours,
- Traffic Damage,
- Overlays,
- Raising Grades,
- Basin Flooding,
- Slides,
- Work on active Construction projects,
- Traffic Control Devices,
- Landscaping, Roadside Appurtenances,
- Timber and Debris Removal,
- Project Features Resulting from the *NEPA* Process.

A minimum \$5000 in repair cost per site is used as a non-regulatory guideline to be considered eligible for ER funds. Also, 23 CFR Subpart 668A includes a \$700,000 disaster eligibility threshold. In other words, for a formal declaration that a disaster has occurred, the combined cost to restore all damaged areas must exceed \$700,000. This will also be marked by a declaration of the Governor.

- ***Application Information***

For more information, contact your Local County road supervisor, or the following:

Jeff Ebert, P.E. (406) 444-7639
Montana Department of Transportation
2701 Prospect Avenue, Rm 109
PO BOX 201001
Helena, MT 59620-1001

John Perry, P.E.
Federal Highway Administration
2880 Skyway Drive
Helena, MT 59602
(406) 449-5308

Table C-1 Local Financing Tools

Funding Strategy	MCA References	Subject to 105?	Election or Petition Required?	Uses
Bridge and Road Mills	7-1-2111, 7-14-2201, 7-14-2501, 2502, 2504	yes	no	Bridges, Roads and Equipment
Depreciation Reserve Funds	7-14-2506	no	no	Bridges, Roads and Equipment
County CIP Funds	7-6-2219, 2220, 2221	yes	no	Bridges, Roads and Equipment
Life Cycle Costing for Road Equipment	None	no	no	Equipment
Gas Tax Allocation	15-70-101	no	no	Bridges, Roads and Equipment
PILT/Timber Receipts	None	no		Bridges, Roads and Equipment
Optional Motor Vehicle Tax	61-3-537	no	yes	Bridges and Roads
Local Option Motor Fuel Excise Tax	7-14-301	If created by resolution	local initiative or resolution	Bridges, Roads and Equipment
Oil and Gas Leases	7-14-2505	no	no	Bridges, Roads and Equipment
Rural Improvement Districts	7-12-2102, 2103, 4102	no	yes	Bridges, Roads and Equipment
Local Improvement Districts for Roads	7-14-2701, 2733	no	petition	Roads
General Obligation Bonds	7-14-2521	no	yes	Bridges, Roads and Equipment
Revenue Bonds	7-7-2501	no	in certain cases	Bridges, Roads and Equipment
Tax Increment Financing	7-15-4201 (municipalities only)	no	no	Bridges, Roads and Equipment
Impact Fees	76-3-510, 203	no	no	Bridges and Roads
Voluntary Programs	None	no	no	Bridges and Roads

Table C-2 Montana Department of Transportation Programs

Program	MCA References	Funding Source	Eligibility Issues	Allocations and Matching	Planning Considerations	Uses
Federal Aid Programs	60-2-126, 127	Federal TEA-21	STIP* inclusion			
Secondary Road Program	6-2-125	Federal TEA-21	STIP Inclusion 65% Capital Construction	86.58% Fed. 13.42% Non-Fed	County and MDT input	Bridges and Roads
Urban Highway System	60-2-125	Federal TEA-21	STIP inclusion in/near inc. cities of 5000	86.58% Fed 13.42% Non-Fed	local governing body and MDT	Bridges and Roads
Pavement Preservation	60-3-206	State Gas Tax	STIP inclusion 35% Pavement Preservation	Variable, No Match	Pavement Management System	On-system Roads
HBRRP** Off-system		Federal TEA-21	STIP inclusion	80% Fed 20% Non-Fed 35% of available funding	County and MDT	Off-System Bridges
HBRRP on-system		Federal TEA-21	STIP inclusion	80% Fed 20% Non-Fed 65% of available funding	County and MDT	On-System Bridges
Forest Highway Funds		Federal TEA-21	Federal Highway Administration,	Public Lands Highway Program	MDT and U.S. Forest Service with input from Counties	Bridges and Roads
STPHS***		Federal TEA-21	Participate in Accident Reporting	90% Federal 10% State/Local	State-wide Rating and Priority	Bridges and Roads
Transportation Enhancements		Federal TEA-21	Identified Eligible Activities	87% Federal 13% Local	Local Gov. Priorities	Enhancements

*STIP State Transportation Improvement Program

**HBRRP Highway Bridge Replacement or Rehabilitation Program

*** STPHS Federal Hazard Elimination Program

Table C-3 Other State and Federal Funding Sources

Funding Source	Loan/Grant	Authorization	Eligible Uses	Agency	Funding Cycle	Allocations/Matching Requirements
TSEP*	Both	90-6-701, MCA	Bridges	Montana Department of Commerce	Every two years	50% match, awards cannot exceed \$500,000
Montana InterCap Program	Loan	State	Bridges, Roads and Equipment	Montana Board of Investments	On-going	Up to \$500,000 (SID based loans cannot exceed \$300,00)
CDBG**	Grant	Federal/State	Bridges and Roads	Montana Department of Commerce	Annual	25% local match, awards cannot exceed \$500,000
EDA*** Public Works Program	Grant	Federal	Bridges and Roads	U.S. Department of Commerce	On-going	20 to 5% local match required
Wood in Trans. Program	Grant	Federal	Bridges	U.S. Forest Service	Annual	50% match, amounts vary by type of bridge
Federal Emergency Management Agency Funds	Grant	Federal	Bridges and Roads	FEMA	As needed	N/A
Federal Highway Administration Emergency Relief	Grant	Federal	Bridges and Roads	FEMA	As needed	100%<180 Days >180 Days 80/20% non-federal match

*TSEP - Treasure State Endowment Program

**CDBG - Community Development Block Grant

***EDA - Economic Development Administration

Appendix D

Road System Planning

I. Introduction

Roads are the economic lifeline of every community, allowing for the movement of people and products. They are an essential part of our lives. However, the job of building new serviceable roads and maintaining existing roads is becoming more difficult. Tax freeze initiatives such as Initiative 105 and the increasing costs of labor, equipment and material, limit the amount of money available to do the job. In addition, increasing traffic is causing roads to deteriorate faster than they can be maintained. The problem is intensified on some county roads that were not designed for the higher volumes and heavier loads of today's traffic. Finally, many of these roads have exceeded or are approaching their design life span. The maintenance costs for these older roads are higher than for newer roads. In many cases, there is a valid argument for reconstruction of these roads.

Costs are increasing for a variety of reasons. Environmental regulations are now more stringent. New safety standards are being developed that make the costs of constructing and maintaining new roads more expensive. Injury and accidents caused by unsafe and poorly maintained roads are resulting in lawsuits while money that could be better spent on road construction and maintenance is being spent on legal defense or liability insurance.

One way to control cost is to keep roads in good condition over their design life. Poorly constructed roads result in high maintenance costs and a shorter life span. Inadequate maintenance, however, jeopardizes the structure of the road and results in the need for road reconstruction. Reconstruction is significantly more expensive than regular maintenance.

Road design should be done by trained individuals. There are many factors that influence good design, including topography, drainage, subgrade material, load design, projected life of the road and economic considerations. It is of little benefit to have a well constructed, well drained and paved road that drifts in with each snowfall or washes out each spring. Constructing a road properly the first time is always the least expensive alternative in the long run.

There are no easy answers. Road maintenance, rehabilitation and reconstruction are a continual process. Evaluating road conditions, setting priorities for improvements and preparing long-range maintenance plans are ongoing needs that have to be incorporated into the process. Finally, there is a very real fear that the road infrastructure is deteriorating because cost cutting measures force attention only to the surface condition of the roads. As a result, little attention may be given to drainage or the underlying road structure itself.

Investing in the construction of new roads and the maintenance of existing roads is a continuing effort that requires strategic planning. The planning process, if done properly, will provide the community with a long range plan to address the needs of their

road system. Additionally, a planning process that includes the public can increase public support by providing the citizens with a better understanding of the components of the road system, the magnitude of the public investment and the implications of budgetary constraints.

It is important to remember that bridges are a key part of the road system and should be included in road system planning. The topic of bridge planning and assessing the condition of bridges is sufficiently complicated to justify a separate appendix. As the road system plan is prepared, bridge system planning will need to be integrated in the process.

II. Preparing a Plan

There are a number of steps in preparing a long range plan for a road system. The planning process is straight forward but does have a number of components. Managing the various components in the real world of changing conditions can be difficult. Figure D-1 illustrates the logical steps in the planning process.

An important tool that is increasingly used in the planning process is computer software. The software is designed with the flexibility to preserve local decision-making control and to reflect local management practices. The software is a valuable tool in many regards. The software can catalog characteristics of the road system, define optimum time for maintenance, and can develop long-range improvement programs for each road segment. Based upon road data, the program can predict needed maintenance before it becomes a problem and source of complaints.

The most valuable aspect of the software is that it forms a basis to support management decisions. The program can objectively predict budget requirements. Predicting budget requirements is based upon objective road use and road condition parameters. This will allow the public to see the outcome, in road condition terms, of revenue allocation decisions. The ability to make decisions with this kind of information and analysis takes the debate over road expenditures to a higher level than just the condition of the road surface, since it requires consideration of the structural condition of the transportation infrastructure and what future costs will be if road segments are allowed to structurally deteriorate. In short, computer programs provide a solid base for making road management and budget decisions, not just in the short run, but in the long run, as well.

Figure D-1
Development Steps for the Plan

A. Road System Map

The first step in the process is to prepare a map of the road system. The Montana Department of Transportation (MDT) has available road system maps for each county. These maps are at various scales, including a scale of 1 inch = 1 mile and show the road pattern in the county. They can be coded to show the general condition of the road system and for public information purposes. The road system maps also contain the location of bridges with spans of over twenty feet. This information will also be important during the bridge system planning phase of road system planning (refer to Appendix E for more information on mapping for the bridge system). Road maps should be available at 1 inch = 500 feet in the county clerk and recorder's office and can be adapted from the county property record books. These road system maps can be updated and enhanced to meet the needs of the individual jurisdiction. Placing the road maps on computer based mapping will allow easy modification and the addition of information as it becomes available. In addition, the road maps can be adjusted in scale to meet the needs of the field inspectors or for public educational use.

B. Road Characteristics

In addition to locating all roads on a map, each road should have various characteristics identified:

- jurisdictional responsibility
- functional classification
- type of construction
- soil type
- type of drainage
- physical condition

1. Jurisdictional Responsibility

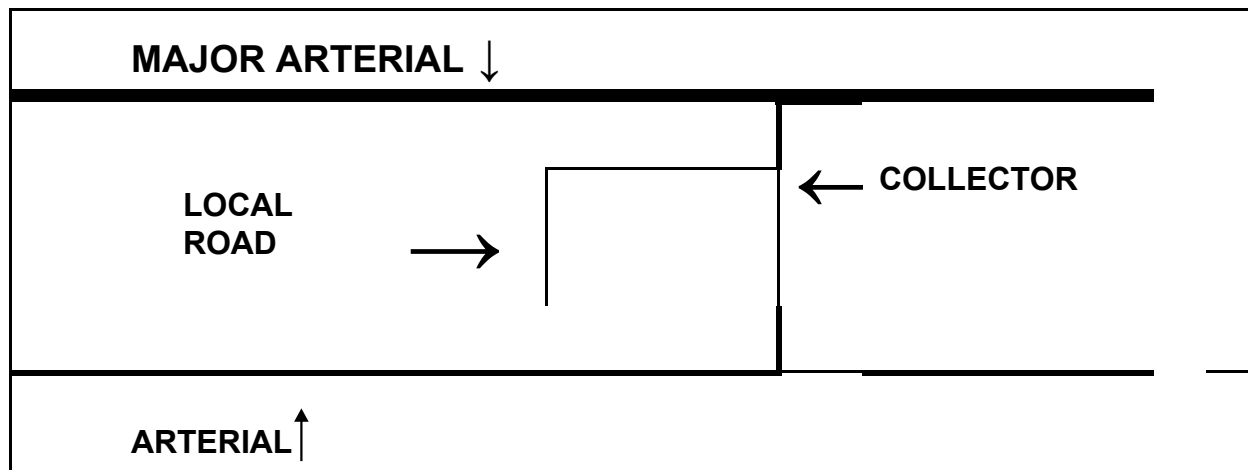
- **On-System Roads:** These include interstate and non-interstate national highways, designated urban routes, primary and secondary highways. There are 12,842 miles of "on-system" roads of which 4,437 miles are maintained by Montana counties.
- **Off-System Roads:** All other roads are classified as "off-system" and account for a total of 56,738 miles both inside and outside incorporated areas. Counties are responsible for a significant portion of "off-system" roads.

2. Classification of the Road System

Once the road system is identified by jurisdictional responsibility, roads are classified by their functional use. All public roads in Montana are functionally classified by the MDT in accordance with Federal statutes and guidelines and through a cooperative process with Montana's local governments, tribal governments, and Federal land management agencies. This functional classification is the basis for the on-system designation and ultimately federal-aid eligibility. Use of the existing classification system is encouraged as many of the roads cross county lines and should be considered within the framework of how they "function" in the statewide, regional and national transportation networks. Information on the state's functional classification of a particular roadway can be obtained by calling MDT-Special Studies, at 444-7289.

Roads fit into a definite hierarchy based upon use. Elements of the major road network are typically classified as principal arterials, minor arterials, collectors and local roads. These classifications are assigned based upon their operational characteristics and overall importance. “Principal arterials” are the corridors with the highest amount of traffic over the longest distance. They connect major cities, regions and states. Minor arterials are used for trips of moderate length and carry less traffic than principal arterials. “Collectors” provide a link between the local roads and minor arterials. “Local roads” provide a singular function - access to a specific location. While the higher road classifications also provide access, their primary function is to carry traffic between destinations. (Refer to Figure D-2 for an illustration of road system classifications).

Figure D-2
Road System Classifications



3. Obsolete Roads

In some instances, existing roads or existing rights-of-way no longer serve the public. These roads or rights-of-way *may* be considered obsolete. Prior to Montana becoming a state and in the early days of statehood, roads existed that were used by the public. These roads were identified by the Government Land Office (GLO) when they surveyed the territory and broke the land into square mile sections. These roads are referred to as “GLO roads.” Later, many counties in Montana accepted the GLO roads as legitimate county rights-of-way. In addition, many roads were created in Montana’s early years by petition or public use and these roads appear in county road books or in the journals of the county commissioners. Many of these historic roads were obliterated by settlement and growth and new routes were established to better serve the public. Many of these rights-of-way still exist even though, in many cases, the roads that used to occupy them are gone. It is important to identify these roads as part of the inventory of county roads and rights-of-way. It is equally important to develop a plan or strategy so that roads and rights-of-way that are of current and future importance can be retained and those that are not needed can be abandoned. Careful consideration should be given to the future needs of the county.

The county has several options. Obsolete roads can be closed, altered or abandoned. Title 7, Chapter 14, Part 26, MCA, deals with the procedure for altering or abandoning a county road. In some instances, it may be advisable to vacate the right-of-way if it is not currently needed or will not be needed in the future. Public participation is a required part of altering or abandoning roads.

4. Types of Road Construction

Identification of various types of road construction is the next step. Each section of road should be distinguished by surface width, surface type and thickness, type of subbase, base and type of subgrade. There are many types of road surfaces. Some types of typical road surfaces that may be encountered on county roads are:

- **Concrete.** These road surfaces consist of a surface of Portland cement mixed with an appropriate amount of sand and gravel to form concrete.
- **Asphalt.** This is high quality, thoroughly-controlled hot mixture of asphalt cement and well graded, high quality aggregate, thoroughly compacted into a uniform dense mass.
- **Asphalt Pavement Structure.** Asphalt pavement structures are placed above the subgrade or improved subgrade, with all the courses consisting of asphalt-aggregate mixtures or a combination of asphalt and untreated aggregate courses.
- **Gravel Surface.** These roads contain a well-graded gravel surface constructed above a subbase.
- **Primitive.** These roads are constructed on native soil with little or no subbase or surface gravel. Primitive roads have minimal drainage and typically were created by driving across an area or by roughing in a road for occasional or light traffic.

The shoulder width should be specified along with its surfacing. Bridge and drainage crossings should be noted as to type and width, as appropriate. In addition, an index should be prepared that identifies the supportive strength of the subgrade material. This can be accomplished by on-site observation by a trained individual or it can be done on a reconnaissance level by using data from the soil survey.

Figure D-3 Typical Road Section

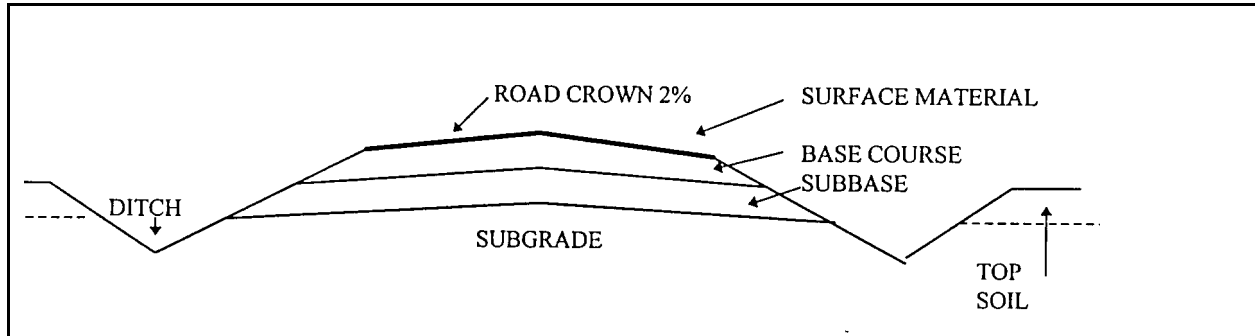


Figure D-3 illustrates the relationship of the structural components of the road. Note that the topsoil is stripped away. This removes any organics from the subgrade to minimize compression when loaded with vehicle traffic. Then the ditches are cut to a depth well below the structural section of the road to ensure proper drainage and to keep water out of the structural section. Material from the ditches, if suitable, can be compacted and used to build up the subgrade. The subgrade is shaped with a minimum of 2 percent crown to ensure proper drainage. The subbase is placed and compacted. The depth of the subbase is a function of the subgrade bearing capacity and the design parameters of the road. In suitable gravels, the depth of the subbase is minimized. In poor soils, the depth of the subbase in combination with the base and surface material is necessarily thicker. Next, the base course is compacted in place and surfacing material follows. All road section components work in combination to provide a stable structure for traffic.

5. Importance of Soils

Most of the counties in Montana will have a soil survey. The soil survey will typically identify the soil type through several soil horizons. The soil layer remaining, after the organic layer is stripped off, will be the subgrade material. The subgrade material is important. Each type of soil has different load bearing characteristics. Soils have been divided into ten classes that can be identified in the field or in the soil survey. Each soil type has significantly different implications for road design:

- **Clean Gravels.** The dominant constituent is gravel and less than about 5 to 10 percent is silt or clay. These gravels may be further subdivided as being “well graded” or poorly graded, according to whether or not the particle sizes fill the whole range from fine to coarse.
- **Silty and Clayey Gravels.** Mostly gravel, with more than 10 to 12 percent silt or clay.
- **Clean Sands.** Mostly sand, less than 5 to 10 percent silt or clay, also subdivided as well as graded or poorly graded.
- **Silty and Clayey Sand.** Mostly sand, with more than 10 to 12 percent silt or clay.

- **Nonplastic Silts.** Inorganic silts or very fine sands, with liquid limit of less than 50 (that is, flow like a liquid when containing less than 50 percent water).
- **Plastic Silts.** Inorganic silts with a liquid limit over 50.
- **Organic Silt.** Silts with substantial organic matter and a liquid limit under 50.
- **Nonplastic Clay.** Inorganic clays with a liquid limit under 50.
- **Plastic and Organic Clay.** A liquid limit over 50, and being either predominantly inorganic clay or a silt, with a liquid limit over 50, or, a clay with substantial organic matter.
- **Peat and Muck.** Predominantly organic material, whether plant remains are visible (peat) or invisible (muck).

(Source: *Site Planning, Second Edition*, Kevin Lynch)

Table D-1 provides each of the ten soil classes and the characteristics of each type as it relates to suitability for road construction. The gravels are the best suited for road construction. They have structural strength, are well drained and are not susceptible to frost heave or compression under loads. Nonplastic clays can be suitable if they are kept dry. The plastic organic clays are usually not suitable, clays will swell when wet, silts will frost heave. Organic material such as peat or topsoil with organic material will compress under a load.

Table D-1
Engineering Characteristics of Soils

<i>Soil Class</i>	<i>Stability Loaded</i>	<i>Stability w/Frost</i>	<i>Drainage</i>	<i>Road Subgrade</i>	<i>Base Course</i>
Clean Gravels	Excellent	Good-Excellent	Excellent	Good-Excellent	Good-Poor
Silty and Clayey Gravels	Good	Fair-Good	Very Poor-Fair	Good	Poor-Good
Clean Sands	Excellent	Good-Excellent	Excellent	Fair-Good	Very Poor-Poor
Silty and Clayey Sands	Fair-Good	Poor-Good	Very Poor-Fair	Fair-Good	Poor-Fair
Nonplastic Silts	Fair-Good	Very Poor-Fair	Poor-Fair	Poor-Fair	Very Poor
Plastic Silts	Poor	Very Poor-Fair	Poor-Fair	Poor	Very Poor
Organic Silts	Poor-Fair	Poor-Fair	Poor	Poor	Very Poor
Nonplastic Clays	Fair	Poor-Fair	Very Poor	Poor-Fair	Very Poor
Plastic and Organic Clays	Poor	Fair	Very Poor	Very Poor-Poor	Very Poor
Peat and Muck	Very Poor	Good	Poor-Fair	Very Poor	Very Poor

Source: Adapted from *Site Planning, Second Edition*, Kevin Lynch

The implications of Table D-1 should be clear, of the ten soil types, only two, clean gravels and silty and clayey gravels, can be rated as good road materials for subgrade and for subbase materials. Roads traverse all across Montana regardless of soil type. Because soil types vary, the costs of road construction vary broadly throughout the state and across counties. This variability in soil types has a direct relationship to the cost of road construction and the maintenance costs of existing roads. Trained personnel can design road sections based upon the characteristics of the subgrade, design loads for the road, and the expected life of the road.

Soil characteristics are also directly related to maintenance costs. For example, Teton County has gravel soils in the western portion of the county and silt and clay soils in the eastern portion. The roads built on gravel soils cost less to construct because, in many cases, the subgrade can be used as subbase material. Further, gravel sources are close at hand, reducing the cost of hauling gravel over long distances. This, in turn, reduces maintenance costs. Roads in the eastern part of the county, constructed on silt and clay soils, are more expensive to construct because the gravel base must be

thicker to provide the necessary support. The subgrade cannot be used for base. Gravel for base material must be imported, in some cases, from distances in excess of 30 miles. The transportation cost of gravel also increases maintenance costs.

The public is often unaware of the different costs associated with road construction and maintenance. The citizens may want the same per mile expenditures for road maintenance across the county. They certainly want to see the road grader come down their road with the same frequency as their neighbors on the other side of the county. However, if equal maintenance time and frequency were applied to all roads in a county, the result would be inferior roads where unsuitable soils exist. It simply costs more per mile to maintain roads built on poor soils than it costs to maintain roads on good soils. The job of the governing body is to provide equal service to all citizens. This may mean that some areas require more frequent blading than others and allocated funding to specific areas may differ.

6. Culverts and Drainage

Throughout the discussion on road condition, drainage has been emphasized as an important component of the road system. Because inadequate drainage is one of the major causes of road structure failure, it is important to understand the different aspects of drainage.

a. Surface Drainage: A road surface is designed to drain. The typical method of surface drainage is accomplished by "crown construction" - simply making the center of the road higher than the sides. Raising the center of the road allows water to efficiently run off the surface in two directions.

Another method of surface drainage is achieved by cross sloping. The road surface is tipped to one side, allowing drainage across the road. Water must run across the entire surface of the road making this method of drainage inefficient compared to a crowned road section. Cross sloping a road is done when it is disadvantageous to build a crown section. For example, sharp road curves elevated to the outside (to assist cornering vehicles) and road construction on steep rocky slopes, would necessitate consideration of cross sloping. That is, rather than placing the high point or crown in the center of the road to allow equal drainage to both sides, the road is "tilted" all in one direction, away from the steep slope, across the entire road. Often, there is not enough room for a ditch on the uphill side, so the road is out sloped, or "tipped" out and away from the hill side and downhill to accomplish proper surface drainage.

Occasionally a road will be built with an "inverted crown." An inverted crown places the center of the road at the low point and water runs to the center and then flows down the road. This is typical of some older roads and is only used with paved or concrete roads. Inverted crown roads habitually have centerline surface damage caused by the water seeping into centerline joints.

The slope of a crowned or cross sloped road is usually 2 percent. There are special situations where 2 percent may be varied. Superelevation, which is the slant up placed to the outside of a curve, is an example of this. Roads in eastern Montana are often

used by farmers to haul wide implements. It may be that a 2 percent crown would high center some of this machinery. Consideration could be given to flatter crowns or cross sloped roads. This decision should be made in consultation with professional personnel trained in road design.

If water is left to pond on a road surface or is allowed to remain on the surface for any length of time, it will result in surface damage. Water seeps into the cracks of paved surfaces and softens the subbase. The moisture can freeze and expand to cause further damage. The same is true on gravel roads. Soft spots become indentations for water to collect and this causes potholes. Proper maintenance of the road surface to ensure adequate surface drainage is vital to maintaining the life of the surface.

b. Ditches: Once the water leaves the roadway, it enters a drainage system to take it away from the road. Some paved roads use curbs that channel the water along the outside edge of the road to larger drainage systems. Rural roads almost always use road ditches. Properly constructed, a road ditch will drain any water from the entire road section to a point below the surface of the subgrade. Ditches also must carry the water to larger drainage courses.

Ditches must be maintained. They can be obstructed by driveways and field access points. If driveways or access points will block the ditch drainage, adequate culverts should be installed so drainage can pass under them. Debris can collect in ditches, this debris can take the form of trash, dirt, sediment or lawn clippings. Ditches will need to be periodically cleaned so they remain functional.

Roads often cross small natural drainages. Culverts are installed most frequently to channel ditch water underneath the road, as necessary, allowing water to follow the natural topography. A culvert will occasionally fill with sediment or clog with debris and can be damaged a variety of ways (e.g., crushed or smashed ends). Regular inspection, cleaning and repair is necessary.

7. Determining the Condition of the Road System

The next step in the process of preparing a road plan is to conduct a thorough survey of the condition of the roads. A separate section, Addendum to Appendix D, discusses how to conduct a road condition analysis. The Asphalt Institute has two excellent publications, "*A Pavement Rating System for Low-Volume Asphalt Roads (IS-169)*," and "*Asphalt Overlays for Highway and Street Rehabilitation (MS-117)*." These publications can also be used as references in assessing the condition of system roads.

The best method for determining the condition of the road system is by site inspection. Visual inspection of the road should occur during a season when the road components are visible and accessible. There are exceptions to every rule. Frost heave, and some conditions of failure due to subgrade swelling will only occur seasonally. These locations and situations will be apparent to veteran road maintenance personnel. The road surface itself should be visible along with the road ditches and drainage structures. Road condition surveys should be undertaken by trained personnel. A thorough understanding of the structural components of the road is necessary to do a complete

assessment. Another alternative is to share personnel with the necessary expertise from other agencies.

A number of factors contribute to the deterioration of a road surface. The condition of the surface should be considered a symptom of what may be the real problem. The traveling public is only aware of the condition of the driving surface and there is a temptation to do quick fixes to the surface while ignoring the structural components of the road. The site inspection should examine the structural characteristics of the road to assess the overall condition, not just the surface condition. The components include the native material the road is situated on, base material that provides the road with structural integrity, surface gravel or paving that provides the driving surface and the drainage ditches and structures. The road components work together to provide a safe driving surface for the public. Failure of one or more components, through lack of proper maintenance, could result in road failure or more significant costs associated with rebuilding the road, not just surface maintenance costs.

Utilities are often present in the road right-of-way. Utilities can take the form of overhead and underground power, telephone and cable TV lines. Sometimes buried power, gas, telephone and cable TV are present. Sewer and water lines can be buried under some of the roads. Buried utilities within the road or ditch section should be noted as part of the condition of the road analysis. All problems with the road, shoulder and drainage structures should be noted along with the probable causes.

The information on the condition of the road system should be recorded and standardized in a manner that assists overall planning and decision making. A series of recording forms is included as part of the addendum to this appendix. These forms have been adapted from those included in *"The Mini Capital Improvements Plan For Small Towns," Third Edition, March, 1996, Chapter 2.*

The safety of personnel conducting the on-site inspection, as well as the safety of traffic that will encounter the inspection crew, should be considered. Montana has adopted the *Manual on Uniform Traffic Control Devices for Streets and Highways*. If inspectors will be working in exposed traffic, they should review and follow all prescribed safety measures. Appropriate clothing and boots should be worn. Clothing should fit properly and be appropriate for the weather conditions. Reflective, high visibility safety vests must be worn at all times when working in an area with traffic or the potential for traffic. Safety requires personnel to be knowledgeable of the rules and requirements of the job, as well as the appropriate safety rules and standards.

C. Determining Corrective Action

The analysis of the condition of the road system provides valuable information, but it does *not* include an evaluation of the problems and causes themselves. The data regarding road conditions should be analyzed by trained personnel to determine problem sources as a basis for identifying appropriate solutions. Once the cause of each problem has been determined, a range of solutions can be put forth and analyzed.

The solutions should be analyzed based, among other things, upon the following criteria:

- Cost effectiveness of the solution.
- Public acceptance of the solution.
- Governing body acceptance of the solution.
- Ability to implement the solution in a timely fashion.
- Degree to which the solution mitigates the problem.

For example, the analysis of the road condition may define a severe dust problem over a section of road. The first step would be to analyze the subgrade material to see if it is a silt or a clay. Silts and clays consist of very small particles and become easily airborne when incorporated into the road surface. It must be determined if the surfacing gravel contains unacceptable amounts of silt or clay, or, if the structure of the road has failed and allowed silts and clays to migrate up to the surface of the road. The problem of poor quality surface material can be remedied by the use of cleaner material in the future or by treatment of the road surface with dust palliatives. In the second situation, where the road structure has allowed migration of fines to the surface, regular treatments of dust palliative is only a temporary solution. Reconstruction of the road may have to be considered.

Applications of dust palliatives are short term solutions. Reconstructing the road with a proper design is a long term solution. Cost comparisons should be made to compare the cost of paving a road to the regular application of dust palliative. It has been found that while initially more expensive, paving usually is the more cost effective long term solution.

Posting the dusty road with a slower speed is also an alternative. This solution is often not acceptable to the public who will have a propensity to drive at their accustomed speed. Posting a slower speed may not be acceptable to the governing body who will be responsible for enforcing the speed limit.

The analysis of road problems, as illustrated in the above example, may require additional investigation of the situation. It certainly involves the judgment of trained personnel to identify the source of the problem and to define alternative solutions. The same professionalism is required to assess the range of solutions and recommend the best one.

The next step is to determine what remedial action will be necessary to correct any deficiencies noted. If maintenance is necessary, the type of maintenance requirements should be noted. If more than maintenance is required, the action needed should be noted. If the cause and nature of the problem needs further investigation, that should also be noted so necessary steps can be taken to properly assess the situation and identify remedial action. Quite often, there are alternative solutions available to address a problem. The alternatives available for corrective action should not be limited to traditional methods. Veteran road workers have years of experience in the application of solutions to specific problems. They should be encouraged to suggest solutions that

would be effective and cost efficient. Some solutions will need to be reviewed by experienced personnel to ensure they meet current engineering and safety standards. Alternative solutions should be analyzed and the best solution or best alternatives listed for comparison purposes.

Table D-2 presents a few of the problems associated with wear and tear of paved roads. Associated with each problem are a variety of probable causes and alternative solutions ranging from routine maintenance to reconstruction. The table illustrates the variety of causes and solutions available to address a problem. It demonstrates the need for trained personnel and the importance of examining the range of alternatives before selecting a solution to address each problem.

Table D-2
A Sampling of Alternative Solutions
In Pavement Maintenance and Rehabilitation

PROBLEMS	CONTRIBUTING CAUSES				MAINTENANCE		REHABILITATION			
	Structural Failure	Mix Composition	Temp or Moisture Changes	Construction	Patching & Routine Maintenance	Slurry Seal	Surface Recycling	Thin Overlay	Structural Overlay	Reconstruction
Alligator Cracking	X				X	X			X	X
Edge Joint Cracks	X		X	X	X					
Shrinkage Cracking		X	X			X	X		X	
Rutting	X	X		X			X	X	X	X
Upheaval			X		X					X
Potholes	X	X	X	X	X		X		X	

Source: Adapted from, *"Alternatives In Pavement Maintenance, Rehabilitation and Construction,"* Asphalt Institute.

D. Cost Analysis

The next step in the process is to assign cost estimates to the corrective action or new facilities required. If the action consists of normal maintenance, the costs should still be estimated. If the action involves reconstruction or installation of new facilities, the costs should be provided. Costs can be obtained by requesting estimates from local construction firms or by individuals trained in cost estimating.

E. Establishing the Relative Importance of Roads

Finally, we need to examine the relative importance of the various roads within the system, before we can prioritize where and how limited funds should be allocated. A number of factors should be considered in assessing the relative importance of roads. One of the factors is the amount of use the road gets. Roads are important for residential, economic and recreational purposes. They are also important for the provision of services such as police and fire protection, emergency medical services and for mail delivery.

Residential areas, whether sparsely or densely populated, are significant trip generators. It is estimated that a single-family, detached residence will generate up to ten vehicle trips per day. Residents make many trips, some destinations include school, work, shopping and social trips. In addition, residents generate trips from service providers such as the postal service and, most importantly, emergency services. In many cases, there will be several routes available to access residences. In those instances where there is only one route to access homes, that route should have a higher magnitude of importance. Roads serving residential areas must meet a minimum level of service standard on a year-round basis. Residents are usually not shy about requesting road improvements when the condition of the road falls below their acceptable standards.

Another factor is the type of use a road gets. Roads are of great importance to commerce. Our road systems are a vital part of agricultural, mining, timber and other businesses and industries. The road systems must be capable of handling the transfer of raw materials and finished products. While most businesses and industries use the road system on a year-round basis, the timber industry and some aspects of the agricultural industry use the road system more heavily on a seasonal basis. Businesses and industries typically pay higher taxes than residential users and, therefore, expect the road systems to be kept in good repair.

Tourism is playing a greater role in Montana's economy. Our road systems carry visitors and local residents to our extensive recreational areas. As the population ages and residents retire, they will have more free time. The use of access roads to public lands and recreational areas will increase. Recreational use is typically seasonal, however, the needs of both winter and summer recreation should be considered.

The presence of utilities in the road right-of-way is another consideration in establishing the priority rating of road improvements and reconstruction. Additionally, any plans for the future installation of buried utilities should be given consideration in the timing of improvements or reconstruction. For example, it would not be prudent to reconstruct a road immediately if the water main buried under the road is scheduled to be replaced in two years.

It is important to remember that our road system is multi-functional and serves combinations of residential, economic and recreational users. Establishing the relative importance of the individual roads should be accomplished through a public participation process.

F. Establishing Priorities

A number of methods are available to combine the relative importance of the various roads with the condition of the roads. These methods range from in-house analysis to computer programs such as ROADPRO (see the list of similar programs on page 19 of this appendix). Local road departments, in conjunction with local governments, have typically set priorities for road improvement and maintenance programs. This method, in most instances, is very reliable and has kept the road infrastructure intact in our counties. However, as Montana's population continues to grow, residents are demanding a higher level of maintenance. While the miles of road that need to be maintained, and the level of maintenance demanded is increasing, road budgets are not keeping up with this demand. In the face of this dilemma, the decisions of the governing body, as well as the road superintendents, are being questioned relative to their fairness or subjectivity. One way to reduce the debate as to which roads receive more attention is to complete a needs assessment of the entire road system. Decisions as to work priority can be justified objectively based on facts, sound policy, and public participation.

There are forms provided in the addendum to this appendix that can be used in conducting the road condition analysis. Form 6 (Preliminary Road Improvement Priorities) is used to summarize information and provides a column to indicate a road project priority rating. It is important not to confuse the Road Condition Index (RCI) with the project priority. The road in worst condition may not be the project selected as the highest priority in need of corrective action. As priorities are developed and funding sources found, this information can also be added or updated. Incidentally, but importantly, priority rating is placed next to last because the priority rating of a project will change with cost information and funding ability. The process of preparing a long range road system plan is ongoing. The plan should include action steps into the future over the life of the plan.

III. Labor and Equipment Considerations

Two vital components that must be considered in the operation of a road system plan are labor and equipment. The labor force operating and maintaining the equipment are important links in the productivity and efficiency of a road department. Trained personnel that know the equipment and the road system are very valuable to the function of the road department. A disturbing trend among road departments in Montana is that trained personnel are leaving for other jobs. This shift is apparently the result of road department salaries that have not kept pace with other salaries in competitive fields. High staff turnover results in increased training costs. Road departments should be funded at levels that allow retention of trained personnel.

A large budget item is equipment and equipment maintenance. Newer equipment usually costs less to maintain. However, it costs more to acquire than used equipment. Used equipment and especially older, used equipment is less expensive to acquire but is typically more expensive to maintain. Whenever equipment is down for maintenance

or repairs, the operator is not out on the job maintaining the county's roads. This downtime should be included in considering the costs of equipment. The downtime is critical in another way. For example, there is a very brief window when gravel roads are at optimum moisture level for blading. If equipment is in the shop waiting for parts during this time, it will be much less efficient at repairing the gravel surface when the road surface has dried out. When assessing the costs of equipment, the direct and indirect costs should also be considered.

Problems will develop that cannot be addressed with the equipment or the labor available to the jurisdiction. In this case, consideration should be given to obtaining outside help. This could come from sharing equipment, personnel or contracting with an outside entity for the equipment, service or expertise needed to deal with the special situation.

As mentioned in Appendix C, counties can choose to participate in lease-purchase agreements with equipment companies with "buy back" options. Under lease-purchase agreements, the county "rents" road equipment. When the rent payments equal the purchase price, the county becomes the owner. During the rental period, the equipment company provides regular maintenance. When road equipment requires replacement, buy back options enable a county to sell equipment back to the equipment supplier and enter into a new lease-purchase agreement. Lease-purchase agreements can enable a county to keep equipment costs constant and down time for repairs at a minimum. This approach looks at the cost of operating equipment on a per hour basis over the life of the equipment, rather than a one-time purchase price. Teton County, for example, currently takes part in such a program for its road graders. As their equipment supplier provides maintenance on a regular schedule, county crews are able to spend more time grading county roads and less time repairing machinery.

Many Montana counties simply cannot afford new equipment. They are caught in a vicious circle. The inability to obtain newer equipment results in more expensive repairs, down time and less return for the scarce dollars in their road budget. The result is not just rutted or potholed roads, but the loss of the structural integrity of the road. A good way to look at the implications of losing a road because of lack of maintenance can be best demonstrated by looking at the value of the road system.

For example, Teton County has 1,423 miles of gravel road and 120 miles of paved road. Assume it costs \$20 a linear foot to construct new two lane gravel roads, and \$30 a linear foot to construct two lane paved roads. There are 5,280 linear feet in a mile. The investment in gravel roads in Teton County is:

$$1,423 \text{ miles} \times 5,280 \text{ ft./mile} \times \$20/\text{ft.} = \quad \quad \quad \mathbf{\$150,268,800}$$

The investment in paved roads is:

$$120 \text{ miles} \times 5,280 \text{ ft./mile} \times \$30/\text{ft.} = \quad \quad \quad \mathbf{\$ 19,008,000}$$

The total investment is:

\$169,276,800

The people and equipment that maintain our road system are trusted with a very valuable investment. The 1990 census indicates Teton County has a population of 6,500. The per capita investment in the road system is \$26,000 for each man, woman and child in the county.

Cost estimates for road construction must take into account a number of variables. The above estimate is based on the cost to construct roadways assuming the county road department would be supervising local contractors. Different assumptions will yield different costs. For example, the MDT estimates the reconstruction cost of a two-lane paved rural collector at \$100 a linear foot. Using MDT cost figures will triple the value of the public investment in the county-maintained road system in Teton County.

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Modeling Infrastructure Performance and User Costs

State Increment Method of Life-Cycle Analysis for Highway Management

II. MANAGEMENT AIDS ~ Computer Software

The following list of road management programs were compiled from searches on the Internet. As this technology is developing rapidly, it is suggested that county officials contact MDT to learn what programs are currently in use in Montana.

Better Decision

CMS Culvert Management System

FMS Fleet Management System

HUCA Highway User Cost Accounting

IC-EQUIPMAN Info Center Equipment Manager

ICTRL Inventory CTRL

MDMS COUNTY Micro Data Management System

MDMS WEED Microcomputer Data Mgmt. For County Weed

NDEMS North Dakota Equipment Mgmt System

REPLACE Vehicle Replacement Analysis Template

ROADCOST Roadcost/Bridgecost

ROADPRO

ROADS

SCHEDULE MAGIC

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BLANK FORMS

Form 1	Data Summary Form
Form 2	Inventory Data Form (Flexible Pavement)
Form 3	Scoring Key (Flexible Pavement)
Form 4	Inventory Data Form (Unsurfaced Road)
Form 5	Scoring Key (Unsurfaced Road)
Form 6	Preliminary Road Improvement Priorities Form

COMPLETED FORMS

Form 1A	Data Summary Form (Example Paved Road)
Form 2A	Inventory Data Form (Example Flexible Pavement)
Form 2B	Inventory Data Form (Example Flexible Pavement)

FORM 1
DATA SUMMARY FORM

DATE _____

LOCATION _____ Average Total Distress Points _____
SHARED JURISDICTION _____ Riding Quality _____
RCI*=100-Total Dist. Pts. _____

Road Name: _____
From: _____
To: _____
Section No.: _____
Length (to tenths of mile): _____

FUNCTIONAL ADEQUACY

Surface Type: _____
Paved: _____
Asphalt Concrete: _____
Asphalt Pavement _____
Structure: _____
Unsurfaced: _____
Gravel: _____
Primitive: _____

Surface Width: _____ No. of Lanes: _____ Median Width: _____

Parking On Road: Yes _____ No _____

Sidewalks: Yes _____ No _____, at curb _____ detached _____

Average Daily Traffic: _____

Drainage: Storm Sewer _____ V Gutter _____ Unpaved Side Ditch _____

Paved Side Ditch _____ Curb and Gutter _____

Shoulder Width: _____

STRUCTURAL ADEQUACY

Date of Construction: _____

Maintenance History (dates of activity):

Surface Overlay _____ Cost: _____

Seal Coat _____ Cost: _____

Crack and Joint Maintenance _____ Cost: _____

CHECK ONE	SUBGRADE	SUITABILITY
	Clean Gravels	Good-Excellent
	Silty and Clayey Gravels	Good
	Clean Sands	Fair-Good
	Silty and Clayey Sands	Fair-Good
	Nonplastic Silts	Poor-Fair
	Plastic Silts	Poor
	Organic Silts	Poor
	Nonplastic Silts	Poor-Fair
	Plastic and Organic Clays	Very Poor-Poor
	Peat and Muck	Very Poor

Comments:

Work Order Category: _____

RCI - Road Condition Index

100-81 1. No Immediate Maintenance
80-66 2. Routine Maintenance
65-46 3. Overlay or Gravel
45-0 4. Reconstruction

FORM 2
INVENTORY DATA FORM
(FLEXIBLE PAVEMENT)

Road Name: _____ Total Distress Points: _____
From: _____ Inventory Station: _____
Riding Quality (Check one) 1 _____ 2 _____ 3 _____ 4 _____ To: _____

Types of Distress	Degree of Distress	%	of	Area
		1- 15%	16- 30%	31% +
RUTTING _____ Score	Slight			
	Moderate			
	Severe			
RAVELING _____ Score	Slight			
	Moderate			
	Severe			
FLUSHING _____ Score	Slight			
	Moderate			
	Severe			
CORRUGATIONS _____ Score	Slight			
	Moderate			
	Severe			
ALLIGATOR CRACKING _____ Score	Slight			
	Moderate			
	Severe			
TRANSVERSE CRACKING _____ Score	Slight			
	Moderate			
	Severe			
LONGITUDINAL CRACKING	Slight			
	Moderate			

Check One:
Sealed ____
Partially Sealed ____
Not Sealed ____

Check One:

Sealed _____ Partially Sealed _____ Not Sealed _____	Severe			
PATCHING Score	Slight			
	Moderate			
	Severe			

FORM 3
SCORING KEY
(FLEXIBLE PAVEMENT)

Road Name: _____
From: _____

Section Number: _____
To: _____

Types of Distress	Degree of Distress	%			of			Area		
		1-15%			16-30%			31%+		
RUTTING	Slight	0			1			3		
	Moderate	3			4			6		
	Severe	6			8			9		
RAVELING	Slight	3			5			6		
	Moderate	6			8			9		
	Severe	9			11			13		
FLUSHING	Slight	3			5			6		
	Moderate	6			8			9		
	Severe	9			11			13		
CORRUGATIONS	Slight	3			5			6		
	Moderate	6			8			9		
	Severe	9			11			13		
ALLIGATOR CRACKING	Slight	3			6			9		
	Moderate	6			9			12		
	Severe	9			12			16		
		S	P S	N S	S	P S	N S	S	P S	N S

TRANSVERSE CRACKING	Slight	1	3	5	2	4	6	2	4	8	S = Sealed PS = Partially Sealed NS = Not Sealed
	Moderate	3	5	6	4	6	9	4	8	9	
	Severe	5	6	9	6	9	12	8	9	12	
LONGITUDINAL CRACKING	Slight	1	3	5	2	4	6	2	4	8	
	Moderate	3	5	6	4	6	9	4	8	9	
	Severe	5	6	9	6	9	12	8	9	12	
PATCHING	Slight	0			1			3			
	Moderate	3			4			6			
	Severe	4			9			12			
DRAINAGE	Slight	1			5			12			
	Moderate	3			7			9			
	Severe	4			9			16			

FORM 4
INVENTORY DATA FORM
 (UNSURFACED ROADS)

Road Name: _____
 From: _____

Section Number: _____
 To: _____

Types of Distress	Degree of Distress	%	of	Area
		1-15%	16-30%	31%+
CROSS SECTION _____ Score	Slight			
	Moderate			
	Severe			
DRAINAGE _____ Score	Slight			
	Moderate			
	Severe			
WASHBOARDING _____ Score	Slight			
	Moderate			
	Severe			
DUST _____ Score	Slight			
	Moderate			
	Severe			

POTHOLE <div>Score</div>	Slight			
	Moderate			
	Severe			
RUTS <div>Score</div>	Slight			
	Moderate			
	Severe			
LOOSE AGGREGATE <div>Score</div>	Slight			
	Moderate			
	Severe			

FORM 5
SCORING KEY
(UNSURFACED ROADS)

Road Name: _____
From: _____

Section Number: _____
To: _____

Types of Distress	Degree of Distress	%	of	Area
		1-15%	16-30%	31%+
CROSS SECTION	Slight	3	6	11
	Moderate	5	9	15
	Severe	6	12	19
DRAINAGE	Slight	1	5	9
	Moderate	3	7	12
	Severe	4	9	16
WASHBOARDING	Slight	3	4	9
	Moderate	5	6	11
	Severe	6	7	14
DUST	Slight	0	--	--
	Moderate	1	--	--
	Severe	5	--	--
POTHOLE	Slight	4	9	16
	Moderate	7	12	22
	Severe	12	19	28
RUTS	Slight	3	6	7
	Moderate	4	7	10
	Severe	6	9	14
LOOSE AGGREGATE	Slight	1	3	4
	Moderate	2	4	7
	Severe	3	6	11

PRELIMINARY ROAD IMPROVEMENT PRIORITIES

Date: _____

Preliminary Road Improvement Priorities For _____ County

[illegible]

--	--	--	--	--	--	--	--	--	--	--	--	--

* The lower the RCI number, the worse the condition of the road.

FORM 1A
DATA SUMMARY FORM
(EXAMPLE PAVED ROAD)

DATE March 12, 1997

LOCATION Teton Average Total Distress Points 39.5
SHARED JURISDICTION _____ Riding Quality 1.5
SCI*=100-Total Dist. Pts. 60.5

Road Name: Sample Road
From: A Street
To: B Street
Section No.: 12
Length (to tenths of mile): 3250'

FUNCTIONAL ADEQUACY

Surface Type:

Paved: X

Asphalt Concrete:

Asphalt Pavement

Structure:

Unsurfaced:

Gravel:

Primitive:

Surface Width: 24' No. of Lanes: 2 Median Width: None

Parking On Road: Yes X No

Sidewalks: Yes _____ No X, at curb _____ detached _____

Average Daily Traffic: 1,500

Drainage: Storm Sewer _____ V Gutter _____ Unpaved Side Ditch X

Paved Side Ditch _____ Curb and Gutter _____

Shoulder Width: 8'

STRUCTURAL ADEQUACY

Date of Construction: 1970

Maintenance History (dates of activity):

Surface Overlay 1984 Cost: _____

Seal Coat 1987 Cost: _____

Crack and Joint Maintenance 1987 Cost: _____

CHECK ONE	SUBGRADE	SUITABILITY
<input type="checkbox"/>	Clean Gravels	Good-Excellent
	Silty and Clayey Gravels	Good
	Clean Sands	Fair-Good
	Silty and Clayey Sands	Fair-Good
	Nonplastic Silts	Poor-Fair
	Plastic Silts	Poor
	Organic Silts	Poor
	Nonplastic Silts	Poor-Fair
	Plastic and Organic Clays	Very Poor-Poor
	Peat and Muck	Very Poor

Comments:

Work Order Category: **Overlay**

RCI - Road Condition Index

100-81 1. No Immediate Maintenance
80-66 2. Routine Maintenance
65-46 3. Overlay or Gravel
45-0 4. Reconstruction

FORM 2A
INVENTORY DATA FORM
 (EXAMPLE FLEXIBLE PAVEMENT)

Road Name: **Sample Road**
 From: **A Street**
 Riding Quality (Check one) 1 **X** 2 _____ 3 _____ 4 _____

Total Distress Points: **38**
 Inventory Station: **1-1**
 To: **B Street**

Types of Distress	Degree of Distress	%	of	Area	
		1-15%	16-30%	31%+	
RUTTING <u>4</u> Score	Slight				
	Moderate		X		
	Severe				
RAVELING <u>8</u> Score	Slight				
	Moderate		X		
	Severe				
FLUSHING <u>6</u> Score	Slight				
	Moderate	X			
	Severe				
CORRUGATIONS <u>5</u> Score	Slight		X		
	Moderate				
	Severe				
ALLIGATOR CRACKING <u>6</u> Score	Slight				
	Moderate	X			
	Severe				
TRANSVERSE CRACKING <u>6</u> Score	Slight				Check One: Sealed ____ Partially Sealed X Not Sealed ____
	Moderate		X		
	Severe				
LONGITUDINAL CRACKING	Slight	X			Check One:
	Moderate				

<u>3</u> Score	Severe				Sealed ____ Partially Sealed X Not Sealed ____
	PATCHING	Slight	X		
	<u>0</u> Score	Moderate			
	Severe				

FORM 2B
INVENTORY DATA FORM
 (EXAMPLE FLEXIBLE PAVEMENT)

Total Distress Points: **41**

Road Name: **Sample Road** Inventory Station: **B Street**
 From: **A Street** To: **B Street**
 Riding Quality (Check one) 1 _____ 2 **X** 3 _____ 4 _____

Types of Distress	Degree of Distress	%	of	Area	
		1-15%	16-30%	31%+	
RUTTING <u>0</u> Score	Slight	X			
	Moderate				
	Severe				
RAVELING <u>8</u> Score	Slight				
	Moderate		X		
	Severe				
FLUSHING <u>3</u> Score	Slight	X			
	Moderate				
	Severe				
WASHBOARDING <u>8</u> Score	Slight				
	Moderate		X		
	Severe				
ALLIGATOR CRACKING <u>9</u> Score	Slight				
	Moderate				
	Severe	X			
TRANSVERSE CRACKING <u>4</u> Score	Slight		X		Check One: Sealed ____ Partially Sealed X Not Sealed ____
	Moderate				
	Severe				
LONGITUDINAL CRACKING	Slight				Check One:
	Moderate	X			

<u>6</u> Score	Severe				Sealed __ Partially Sealed X Not Sealed __
PATCHING <u>3</u> Score	Slight				
	Moderate	X			
	Severe				

Addendum to Appendix D

The following material has been updated and adapted for county roads from *"The Mini Capital Improvements Plan For Small Towns," Third Edition, March 1996, Chapter 2, "Street System Analysis."*

I. Introduction

Often road maintenance needs are determined by answering complaints in the order they are received or by driving roads and making a list. While these methods work, they lack an objective base of standards for comparing relative needs. The condition analysis allows the local staff to judge the relative condition of roads and to set priorities for performing improvements based upon consideration of the entire road system. Also, using the condition analysis method allows a local government to identify which roads to repair before irreversible crown or base damage occurs. Delaying repairs to a road that needs an overlay can cost the taxpayers up to ten times as much money (because of the higher cost of reconstruction compared to an overlay).

II. How to Perform Road Condition Analysis

The following is a step-by-step outline of the condition analysis procedure. This is a model based on a proven system. However, your engineer or road supervisor may recommend an alternate system that is more appropriate to the needs of your county.

STEP 1. Assemble Materials and Equipment Required to Carry out Road Condition Analysis

The following materials and equipment will be needed to carry out the condition analysis:

- A. Road System Map - a current road map at a scale of 1 inch = 100 ft. to 1 inch = 500 ft. or other suitable scale map.
- B. Vehicle - a vehicle to carry team and equipment.
- C. Measuring Device - a 100 ft. tape or measuring wheel and a 2@ x 4@ stud.
- D. Clip board, pencils, storage folders, stapler, markers and marking crayon, chalk and spray paint - supplies for each team member.
- E. Copies of the blank survey forms located in Appendix D.
- F. All necessary safety equipment, traffic warning and control devices as required.

STEP 2. Divide Each Road into Sections

Condition data will be tabulated for sections of each road that are reasonably consistent throughout their lengths. In most cases, the entire road can be considered as one section. The following are examples of section boundary points that may be used:

- Intersections
- Limits of past or present construction projects
- Limits of seal or overlay projects
- Change in surface material such as from:
 - asphalt concrete to asphalt pavement structure
 - asphalt pavement structure to gravel
 - gravel to primitive
- Change in soil type
- Changes in roadway geometrics such as from:
 - two lane to one lane
 - two lane to four-lane
 - divided to undivided
 - roadway curb and gutter to shoulders only
 - curb and gutter to ditch section
 - ditch section to no drainage
 - year-round route to seasonal route only
- Significant changes in visual appearance of surface or traffic characteristics
- Significant aspects of the road such as:
 - school bus route
 - mail route

STEP 3. Complete Data Summary Form (Form 1)
(Note: All forms are contained in Appendix D.)

Form 1 is the Data Summary Form that will be completed for each road section to be inventoried. Form 1A is a sample of a Form 1 that has been completed.

Road location is defined by the road name and the names of intersecting roads forming the boundaries for the particular road section. Each section should also be assigned a section number to keep the inventory forms in order. Section lengths can be determined from the base map.

Functional data pertaining to surface type, surface width, shoulder width, number of lanes, median width, parking and sidewalks can be measured and recorded during this analysis. Average daily traffic counts may be available from the Montana Department of Transportation or local records. The type of drainage may be available from the county records or can be determined in the field.

Structural data should be available from the county's maintenance records. This information includes the date the road was constructed and the dates of each type of maintenance that has been done on the section. The soil type that forms the subgrade

of the road is important to note if it is on the records. If not, it can be obtained in a general fashion from the soil survey maps. Table D-1 provides information on the suitability of soils for road base and this suitability rating should be noted for each section of road and when the soil suitability type changes.

Comments should include any other information pertinent to this section of road such as; "road section is an asphalt overlay over original concrete; or road widened 4 ft. each side in 1990."

STEP 4. Study and Become Familiar with the Types of Road Indicators of Distress (Problems)

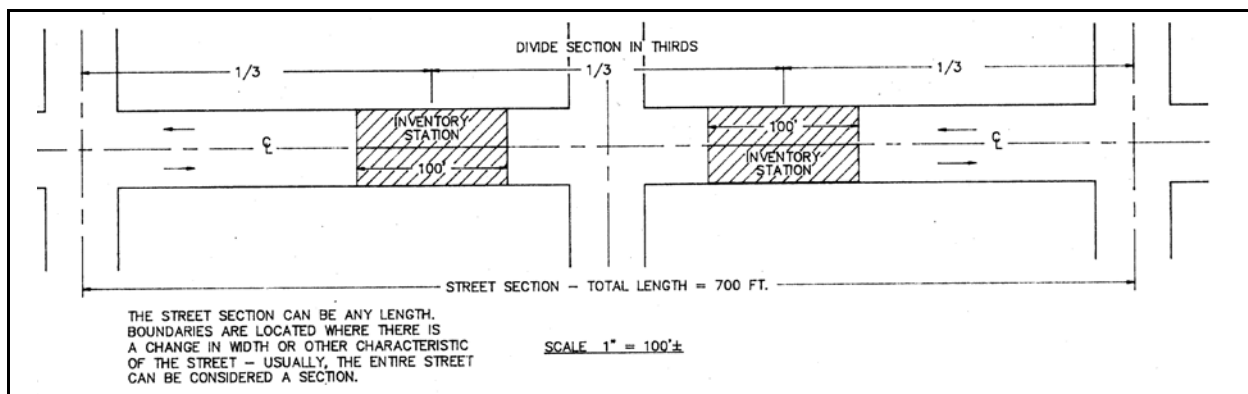
In addition to the Data Summary Form (Form 1), the Inventory Data Form (Form 2) is used when examining roads with flexible pavements (asphalt or similar types of roads). Concrete pavements are not included since very few counties have this type of road.

The Inventory Data Form (Form 2) is used to record the surface condition of the section. Eight types of flexible pavement distress, and seven types of unsurfaced road distress, are observed and recorded during the condition inventory. These distress types are described and shown graphically on the following pages. The survey team should jointly study these distress descriptions and observe examples in the field so each member is able to make an identification consistent with that of other team members.

Point scores are assigned to each road to finally arrive at a Road Condition Index that can be used to rate the condition of paved and unpaved roads for the entire road system.

STEP 5. Select Inventory Stations

The condition survey will be made by inspecting two 100 ft. lengths of road on each road section identified in Step 2. The following diagram shows the method of locating inventory stations.



The condition at the inventory station location should be typical of the rest of the road. If the conditions at the inventory stations as shown on the diagram are not typical of the

rest of the road, a typical location should be selected based on the judgment of the surveyor. Two inventory stations are selected so an average condition can be determined by combining the condition ratings. After selecting inventory stations, the condition survey may be started.

STEP 6. Conduct Road Condition Survey For Flexible Pavement (Asphalt Roads)

Each type of distress is measured within the 100 ft. inventory station, and the severity and extent rating is checked on the Inventory Data Form. If a distress is not present, a zero is entered in the point scope for that distress. Form 2A and Form 2B are examples of completed Inventory Data Forms.

There are eight types of distresses that are measured and used to rate the condition of paved roads. These are as follow:

- A. Rutting
- B. Raveling and weathering
- C. Flushing
- D. Washboarding
- E. Alligator cracking
- F. Transverse cracking
- G. Longitudinal cracking
- H. Patching

Drainage should be included in the condition analysis for paved roads. It is always included for unsurfaced roads. There are many paved roads in Montana with ditch sections instead of curb and gutter. The ditch, when properly maintained, keeps moisture out of the subgrade and subbase and allows drainage from the surface of the road to be carried away from the road section. Poor drainage is one of the most frequent causes of the deterioration of roads, however, it should be addressed as an overall system. It is beyond the scope of this publication to include the overall drainage system as a separate facility. Counties with obvious drainage problems in certain areas of their jurisdiction should contact an engineer with drainage facility experience and should consider the development of a drainage system master plan.

The condition survey of paved roads should be conducted annually. After the initial condition survey, some roads can be eliminated from the annual survey if they are in good to excellent condition or if they have been substantially improved during the year.

As you rate each distress refer to the examples shown in completed Forms 2A and 2B.

A. RUTTING

For the purposes of this survey, a “rut” is a longitudinal surface depression (at least 20 ft. long) in a wheel path. “Wheel paths” are the two worn areas in each travel lane where most drivers position their vehicle. Heavy traffic volumes and heavy loads cause

rutting in these areas. Rutting is usually caused by consolidation or lateral movement of roadbed material under heavy wheel loads.



Severity. The severity rating for rutting is measured by the depth of rutting. The depth of ruts can be measured by laying a yard stick or 2" x 4" over the rut and measuring to the bottom of the rut. The severity is rated as follows:

<u>Slight</u>	-	(depth of ruts) 1/4" to 2"
<u>Moderate</u>	-	(depth of ruts) 2" to 3/4"
<u>Severe</u>	-	(depth of ruts) 3/4"

Extent. The extent of rutting is rated by the percentage of the wheel paths that are rutted. A single rutted wheel path on a two-lane road for the full length of the 100 ft. inventory station constitutes a 25 percent rating. Four rutted wheel paths, two in each travel lane for 50 ft. of the 100 ft. station would be a 50 percent extent rating.

B. RAVELING AND WEATHERING

"Raveling" or "weathering" is the wearing away of pavement surface, resulting in a roughened surface texture due to dislodging of aggregate and loss of bitumen (asphalt binder or tar-like substance).

"Raveling" is the wearing away of the surface, usually as a result of traffic action.
"Weathering" is the gradual disintegration of the surface, usually due to the drying out or loss of asphalt binder.

Ravel due to leaching out of the asphalt binder by oil and gas drippings is called "drip track ravel." Drip track ravel usually occurs at intersections, between wheel tracks, (make note under "remarks" on the inventory sheet).

Abraded surfaces (such as occur in snowfall areas where tire chains are used) should be rated as ravel and weathering. When the damage appears to be caused by tire chains or studs, it should be noted in "remarks" on the inventory sheet.

Severity. The relative degree of raveling and weathering is rated as follows:

- | | | |
|-----------------|---|---|
| <u>Slight</u> | - | fine aggregate and/or asphalt binder has worn away and the surface texture is slightly rough and pitted and some coarse rock is |
| <u>Moderate</u> | - | some coarse aggregate and asphalt binder has worn away and the surface texture is moderately rough and pitted. |
| <u>Severe</u> | - | coarse aggregate and asphalt binder has worn away and the surface texture is severely rough and pitted. |

Open graded surfaces, chip seals, and other surface treatments having an inherently coarse texture do not readily lend themselves to a "coarse" or "fine" ravel rating. An apparent ravel problem with these types of surfacing would be more appropriately described in the "Comments" section of the Data Summary Form (Form 1)

Extent. The extent of raveling and weathering is measured by the percentage of the length of the 100-foot inventory station raveled or weathered. For example, if the total length of raveled or weathered surface in the 100-foot length of inventory station is 25 feet, the extent is 25 percent.

C. FLUSHING

"Flushing" occurs when asphalt comes to the surface of the roadway and partially or completely covers the aggregate making up the wearing surface of the roadway. Flushing is caused by too much oil in the mix.



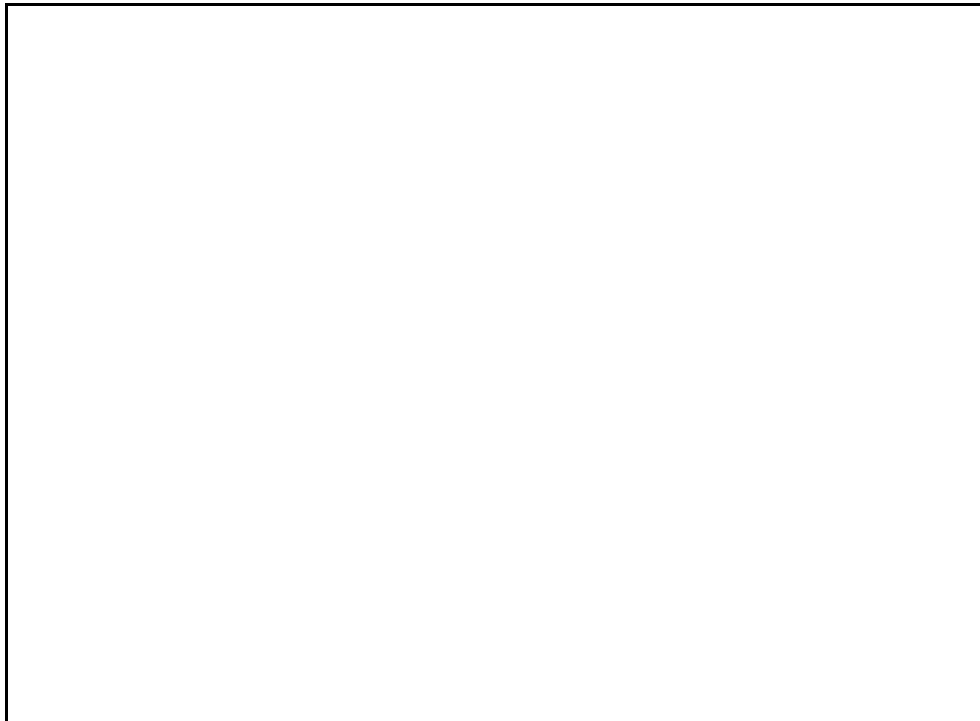
Severity. Severity of flushing is rated by the amount of asphalt coming to the surface. The relative degree of flushing is rated as follows:

- Slight - asphalt is barely noticeable in its coverage of the aggregate.
- Moderate - asphalt is covering large areas of the aggregate.
- Severe - asphalt is totally covering the aggregate.

Extent. The extent of flushing is determined by measuring the length of the areas where flushing has occurred along the 100 ft. inventory station and expressing it as a percentage of the total length.

D. WASHBOARDING

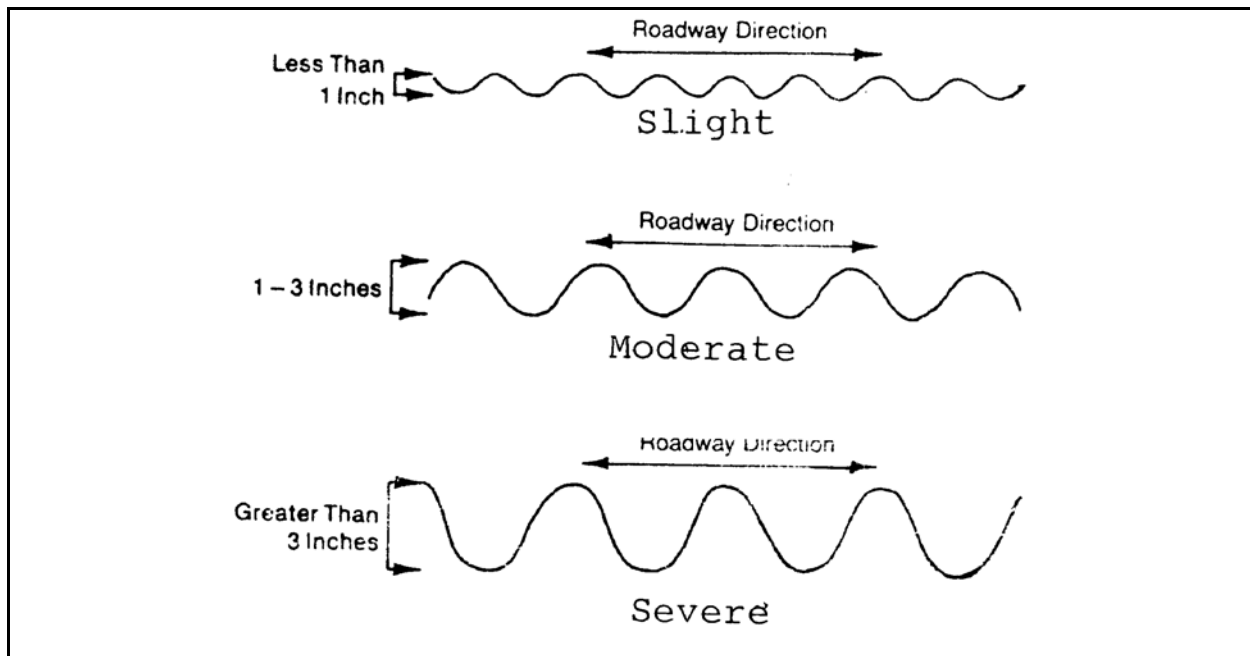
"Washboarding" is a series of closely spaced ripples at fairly regular intervals perpendicular to the direction of travel. This type of distress is usually located in areas of acceleration or deceleration (e.g., near stop signs or in intersections) or in areas where the road is soft or potholed.



Severity. Severity is rated according to the effect the ripples have on the ride quality of the road. The relative degree of washboarding is rated as follows:

- | | | |
|-----------------|---|--|
| <u>Slight</u> | - | ripples are visible. |
| <u>Moderate</u> | - | ripples create a bumpy ride, but do not require the vehicle to reduce its speed. |
| <u>Severe</u> | - | ripples are prevalent enough to require the vehicle to reduce its speed. |

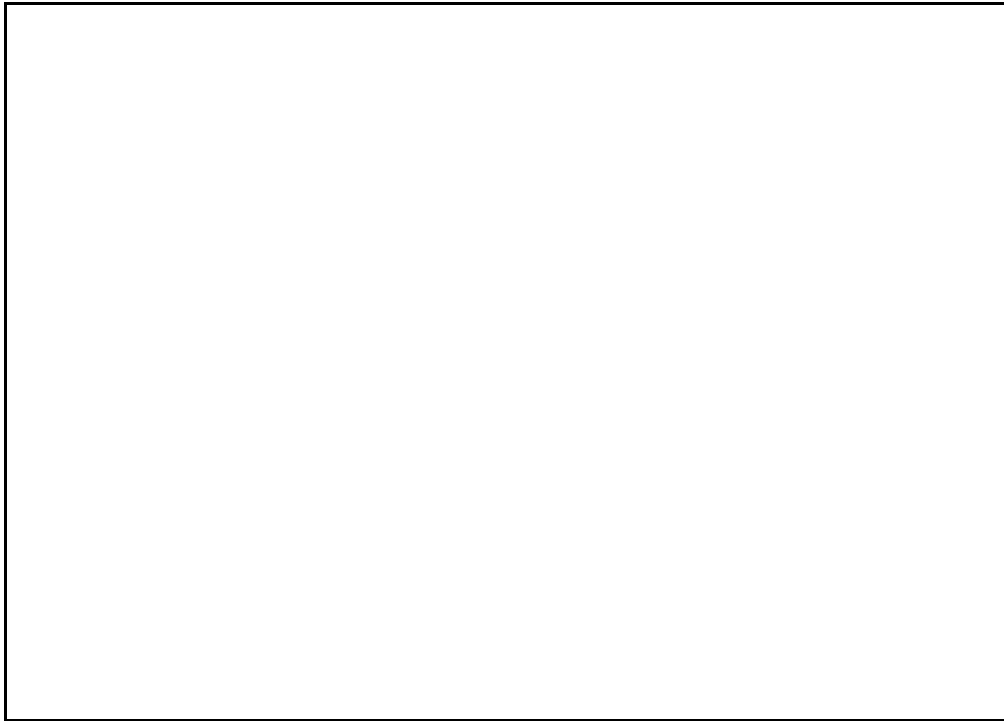
Extent. The extent of washboarding is determined by measuring the length of the rippled areas along the 100 ft. inventory station and expressing it as a percentage of the total length (e.g., 50 ft. washboarded over 100 ft. inventory section is 50 percent extent).



E. ALLIGATOR CRACKING

"Alligator cracking" occurs as interconnected or interlaced fatigue cracks form a series of small polygons. Alligator cracks are always associated with excessive loads, causing failure of the road base.

Initially, a single longitudinal crack or a series of parallel cracks appear in a wheel path. Upon further loading, the cracks interconnect, forming the typical pattern resembling an alligator's skin or chicken wire. Alligator cracking does not usually occur over an entire area. Alligator cracks often indicate base failure (that will require reconstruction of the road's base at that location).



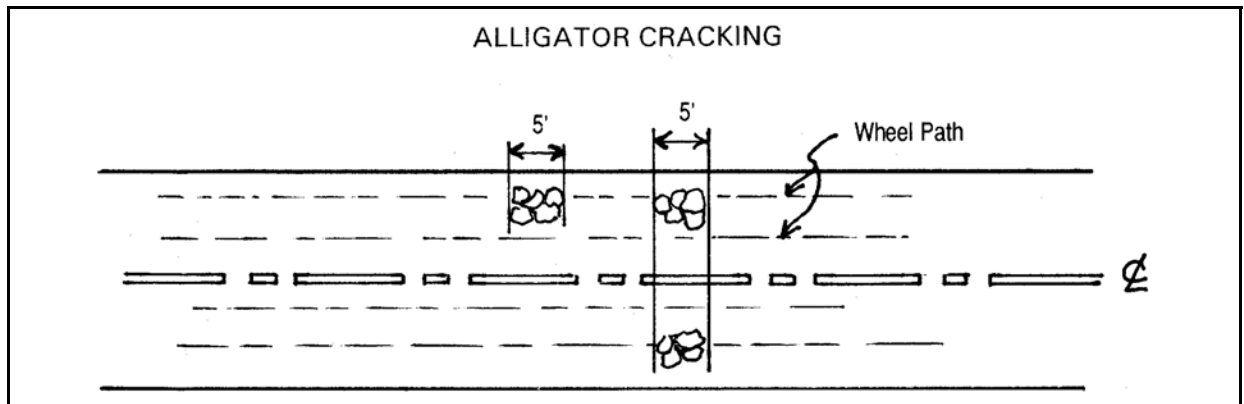
Severity. Severity is rated according to the extent to which the alligator cracking has developed. The relative degree of alligator cracking is rated as follows:

Slight - the initial appearance of fatigue cracks in a wheel path.

Moderate - interconnected fatigue cracks in a wheel path.

Severe - fatigue cracks outside the wheel paths.

Extent. The extent of alligator cracking is determined by measuring the length of the distressed areas along the 100 ft. inventory station and expressing it as a percentage of the total length. The following sketch shows an inventory section with 10 lineal feet of alligator cracking or an extent of 10 percent.



F. TRANSVERSE CRACKING

"Transverse cracking" appears as cracks at approximately right angles to the road's centerline.

Transverse cracks are generally due to shrinkage of the surface course or old cracks resurfacing in a new overlay. They are not usually caused by heavy loads.

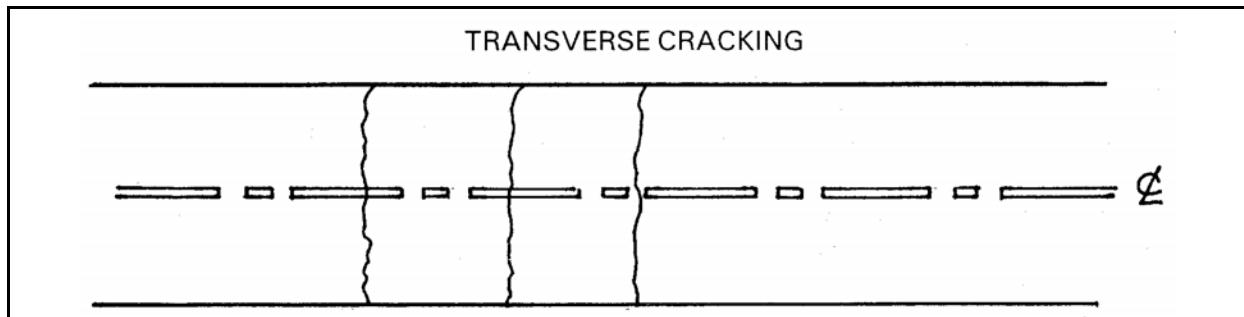


Severity. Severity is rated by the width of the crack. The relative degree of transverse cracking is rated as follows:

- Slight - cracks are barely visible, less than 1/8" in width (hairline). Sealed cracks are rated as hairline.
- Moderate - cracks are from 1/8" to 1/4" in width, but the sides of the crack are not fully separated.
- Severe - cracks are 1/4" or more in width, and the sides of the crack are fully separated.

Extent. The extent of transverse cracking is determined by the number of cracks per 100 ft. inventory station. This is then converted into a percentage range rating. The extent is rated as follows:

- 1 to 3 cracks per 100 ft.: 1 - 15 percent
- 4 to 7 cracks per 100 ft.: 16 - 30 percent
- 8 or more cracks per 100 ft.: 31 percent



G. LONGITUDINAL CRACKING

"Longitudinal cracking" appears as cracks approximately parallel to the pavement centerline.

Longitudinal cracks are primarily caused by opening of paving joints, shrinkage of the surface course, reflection cracking, and roadbed settlement.

Load-associated longitudinal cracks in the wheel path are rated as slight alligator cracking (see "Alligator Cracking").

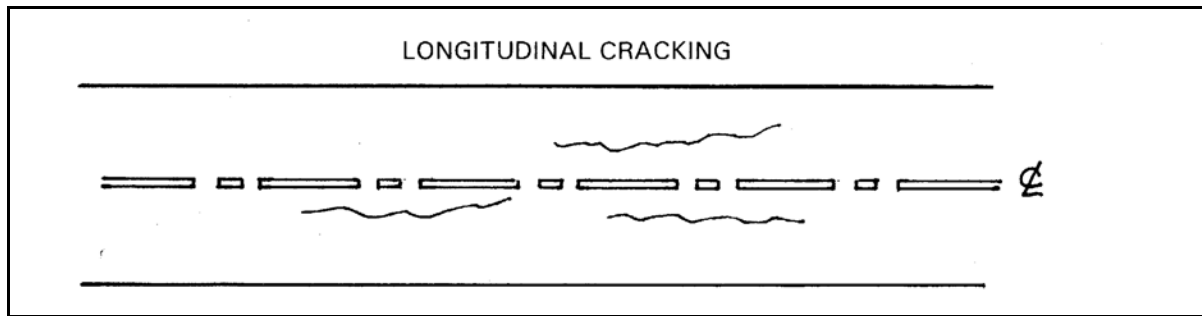


Severity. Severity is rated by the width of the crack. The relative degree of longitudinal cracking is rated as follows:

- | | | |
|-----------------|---|---|
| <u>Slight</u> | - | cracks are barely visible, less than 1/8" in width (hairline). Sealed cracks are rated as hairline. |
| <u>Moderate</u> | - | cracks are from 1/8" to 1/4" in width, but the sides of the crack are not fully separated. |
| <u>Severe</u> | - | cracks are 1/4" or more in width and sides of the crack are fully separated. |

Extent. The extent of longitudinal cracking is determined by measuring the total lineal feet of cracks per 100 ft. inventory station and then converting it to a percentage range rating. The extent is rated as follows:

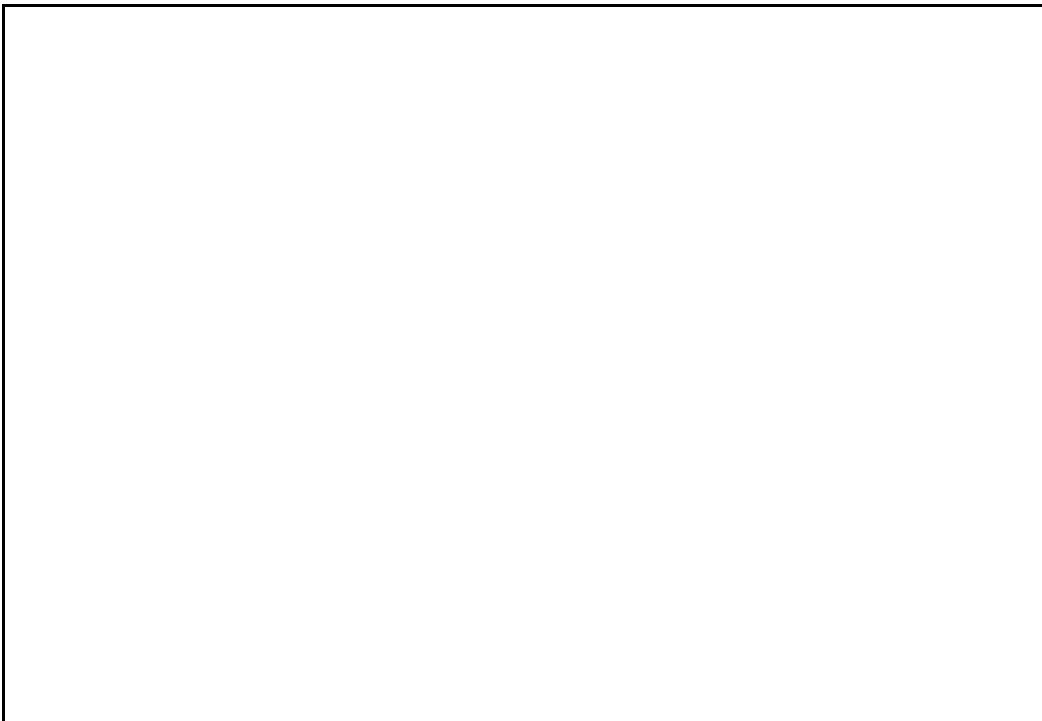
- | | |
|---|-----------------|
| • 100 - 300 lineal feet of crack/100-ft. station: | 1 - 15 percent |
| • 301 - 600 lineal feet of crack/100-ft. station: | 16 - 30 percent |
| • 601 + lineal feet of crack/100-ft. station: | +31 percent |



H. PATCHING

"Patches" are temporary or permanent corrections to damaged pavement. A patch is considered a problem area, no matter how well it is performing.

Materials used to patch flexible pavements may vary, but are usually of asphaltic composition.

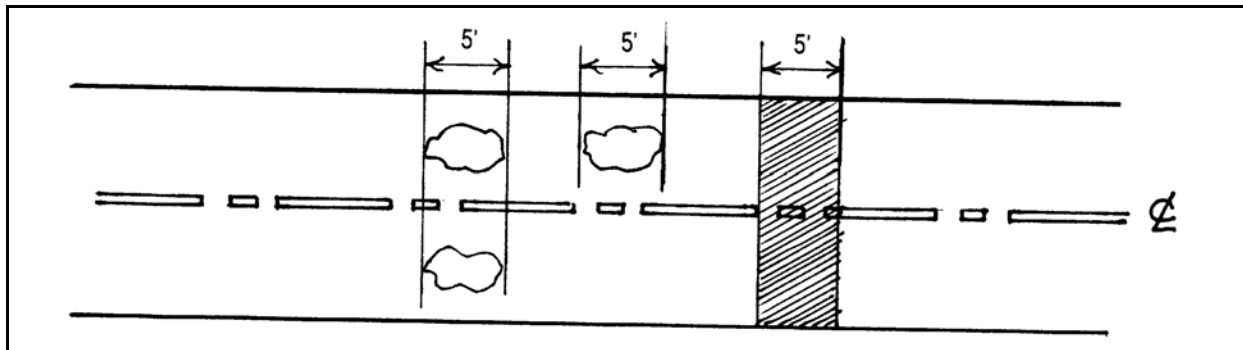


Severity. Severity is rated subjectively according to how surface conditions affect ride. The relative severity of patching is rated as follows:

Slight - patch is in good condition, level with pavement and does not affect ride.

- Moderate - patch is somewhat deteriorated but does not require a vehicle to reduce its speed.
- Severe - patch is in poor condition or has resulted in a pothole requiring a vehicle to reduce speed.

Extent. The extent of patching is determined by measuring the length of the areas patched along the 100 ft. inventory station and expressing it as a percentage of the total length. The following sketch shows an inventory section with patching extent of 15 percent.



STEP 7. Conduct Unsurfaced Roads Survey

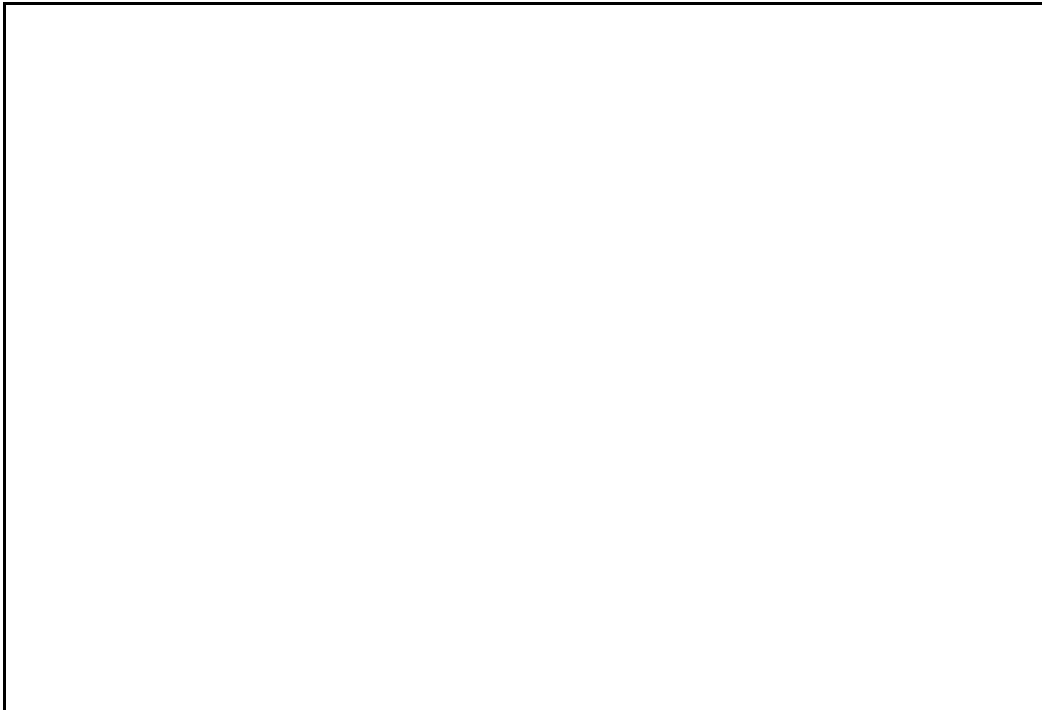
The inventory of unsurfaced roads can be carried out at the same time the paved roads are inventoried. The Inventory Data Form and scoring key are similar to that for paved roads, however, different distresses are present in unsurfaced roads. The unsurfaced roads inventory should be conducted annually. Roads that are scheduled for paving can be eliminated from the inventory. In addition to washboarding and rutting discussed under Step 6 (Conducting a Road Condition Survey for Asphalt Roads), there are five other types of distresses that are measured and used to rate the condition of unsurfaced roads. These are as follows:

- A. Improper cross section
- B. Inadequate roadside drainage
- C. Dust
- D. Potholes
- E. Loose aggregate gravel

The sections that follow describe how to identify and measure the seven distress types for unsurfaced roads. At the completion of the inventory, the inventory team and the governing body should identify any unpaved roads that they wish to pave. The decision to pave is usually based on: amount and type of traffic using the road, desires of property owners, dust control and availability of funds. See form for unpaved roads, Inventory Data Form (Unsurfaced Roads), Form 4.

A. CROSS SECTION

Description. An unsurfaced road should have a "crown" with enough slope from the centerline to the shoulder to drain all water from the road's surface. No crown is used on curves because they are usually banked. The road cross section is improper when the road surface is not shaped or maintained to carry water to the side of the road. The cross section can be more easily seen by laying a 2"x 4" across the centerline of the road.

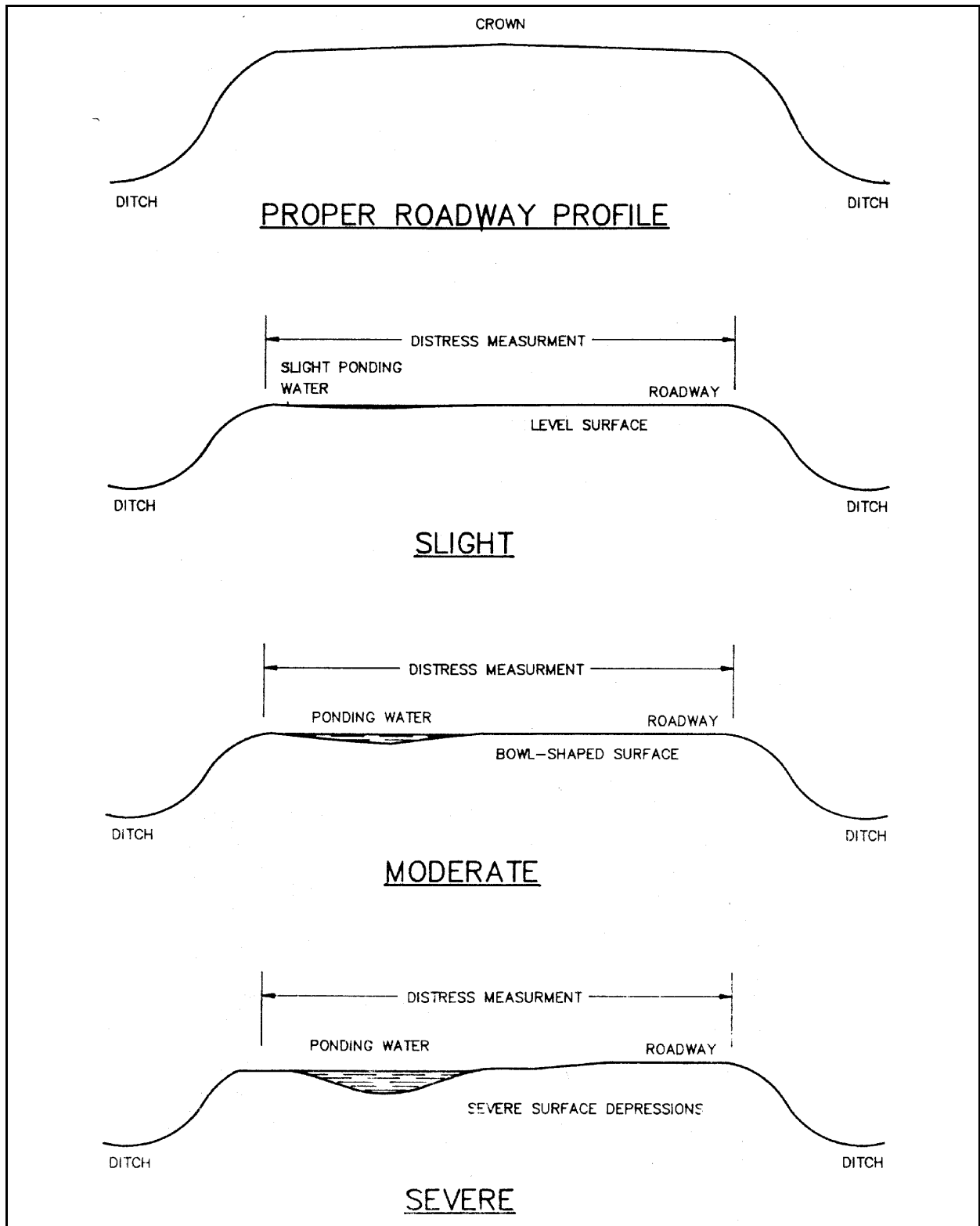


Severity.

- | | | |
|-----------------|---|---|
| <u>Slight</u> | - | small amounts of ponding water or evidence of ponding water on the road surface, or the road surface is completely flat (no cross-slope). |
| <u>Moderate</u> | - | moderate amounts of ponding water or evidence of ponding water on the road surface, or the road surface is bowl shaped. |
| <u>Severe</u> | - | large amounts of ponding water or evidence of ponding water on the road surface, or the road surface contains severe depressions. |

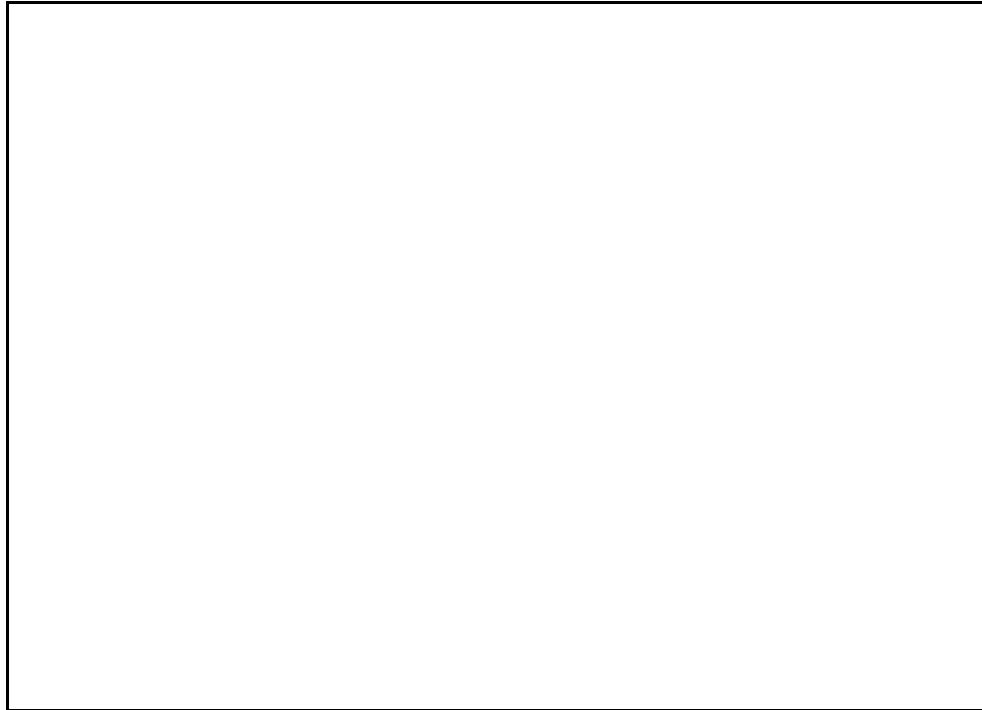
Extent. Cross section distress is measured in linear feet per inventory section (along the centerline or parallel to the centerline). The cross section runs from the outside shoulder break on one side of the road to the outside shoulder break on the other side.

The average severity should be estimated. The extent of 30 ft. of improper cross section in the 100 ft. inventory section would be 30 percent.



B. ROADSIDE DRAINAGE

Poor drainage is generally a primary factor contributing to the deterioration of paved or unsurfaced roadways. The solution to poor drainage involves the development of an overall drainage system, which is beyond the scope of this document. In rural areas, unsurfaced roads are common and have well-defined drainage ditches. In most cases, water is channeled from the road ditches into natural drainage ways and draws.



Severity.

- | | | |
|-----------------|---|--|
| <u>Slight</u> | - | small amounts of ponding water or evidence of ponding water along the edges of the roadway with some debris or overgrowth along the roadway. |
| <u>Moderate</u> | - | moderate amounts of ponding water or evidence of ponding water along the edges of the roadway with debris or overgrowth along the roadway or erosion of the edge of the roadway. |
| <u>Severe</u> | - | large amounts of ponding water or evidence of ponding water along the edges of the roadway with debris or overgrowth along the roadway or erosion of the edge of the roadway into the roadway surface. |

Extent. Drainage problems are measured in lineal feet of distress. The maximum length is 2 times the length of the inventory section (200 ft.). To compute extent, divide the number of lineal feet of distress by 200 ft..

Example: If the section has 50 ft. of distress, $50/200 = 25$ percent extent.

Note: Drainage score not shown in example Form 2A for paved roads. See form used for unpaved roads, Inventory Data Form (Unsurfaced Road), Form 4.

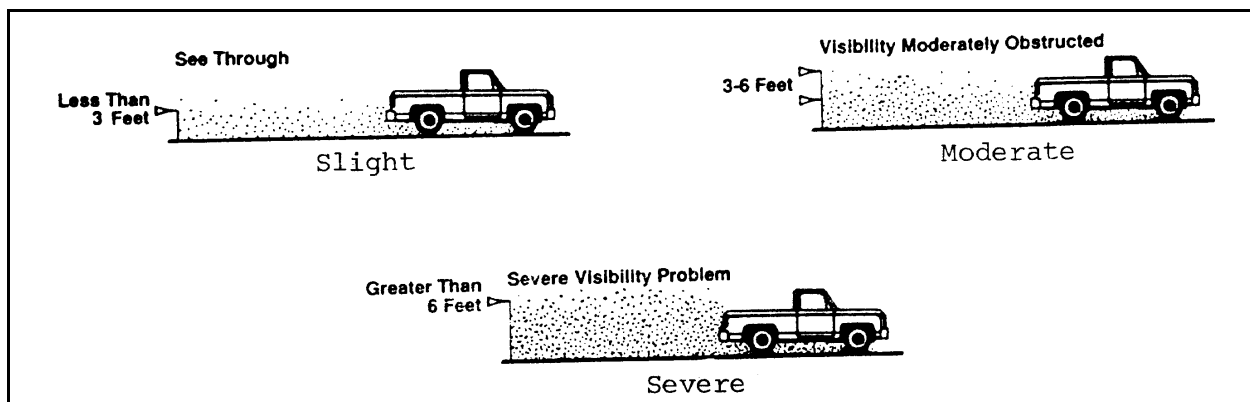
C. DUST

The wear and tear of traffic on unsurfaced roads will eventually loosen the larger particles from the soil binder. As traffic passes, dust clouds create a danger to trailing or passing vehicles and cause significant environmental problems.

Severity.

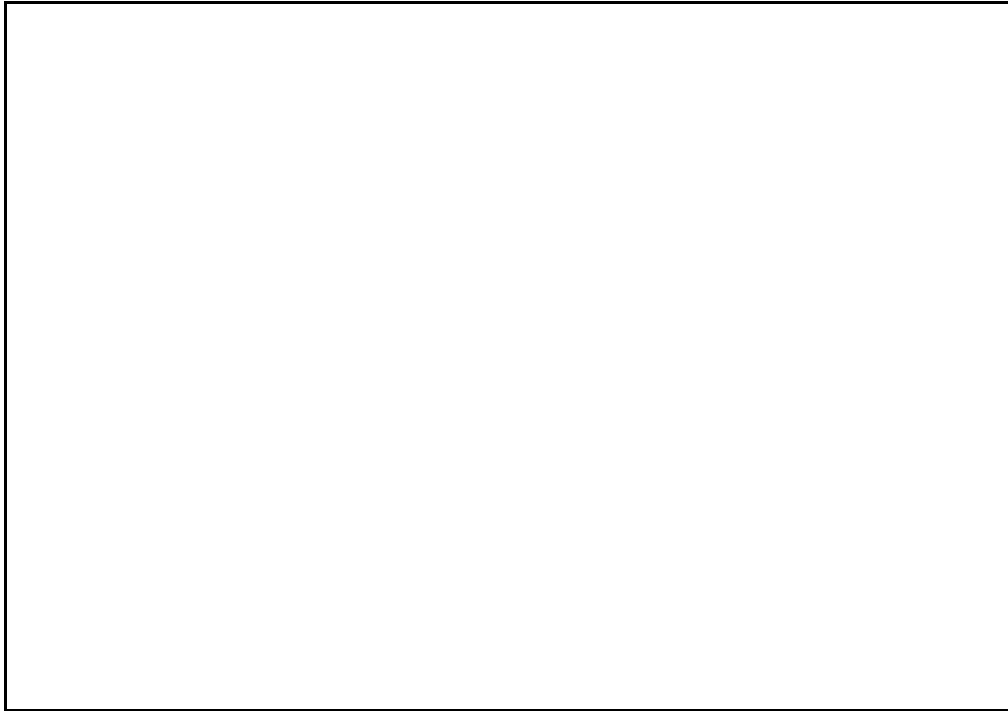
- Slight - normal traffic produces a thin dust that does not obstruct visibility.
- Moderate - normal traffic produces a moderately thick cloud that partially obstructs visibility and causes traffic to slow down.
- Severe - normal traffic produces a very thick cloud that severely obstructs visibility and causes traffic to slow down significantly or stop.

Extent. Drive a vehicle at 25 mph and watch the dust cloud. Dust is measured as slight, moderate, or severe for the sample unit (as illustrated by the diagram below). Dust measurements must be taken on a dry road surface during a relatively dry period.

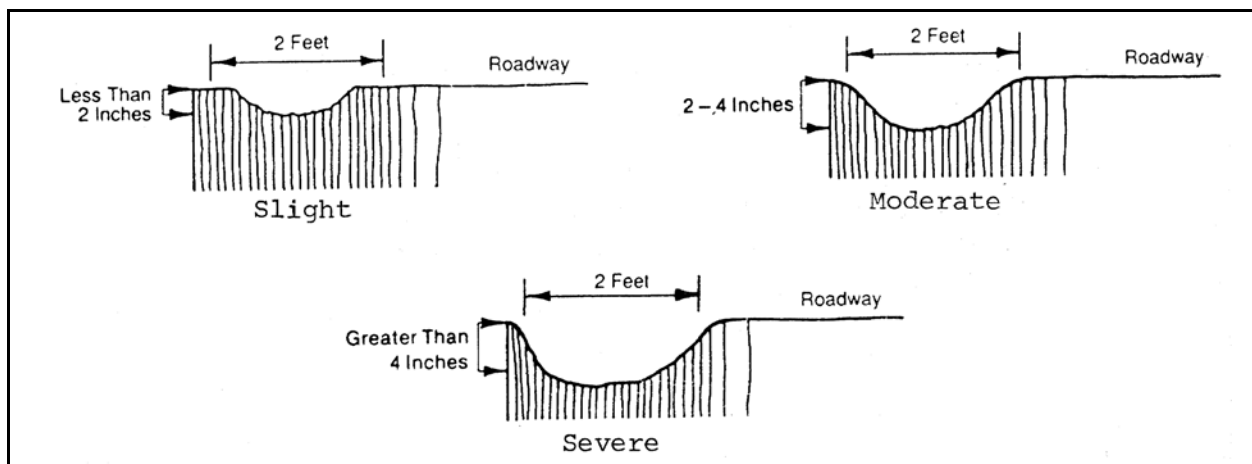


D. POTHOLES

Potholes are bowl-shaped depressions in the road surface. They are usually less than 3 ft. in diameter. Potholes are produced when traffic wears away small pieces of the road surface. They grow faster when water collects inside the hole. The road then continues to disintegrate because of loosening surface material or weak spots in the underlying soils and vehicle impacts.



Severity. The levels of severity for potholes are based on both the diameter and the depth of the pothole according to the following diagram:



Extent. The extent of pothole distress is measured as a percent of the length of the inventory station with potholes. For example, if the total length of potholed roadway along the 100 ft. inventory section is 20 ft., the extent is 20 percent.

E. LOOSE AGGREGATE (Gravel)

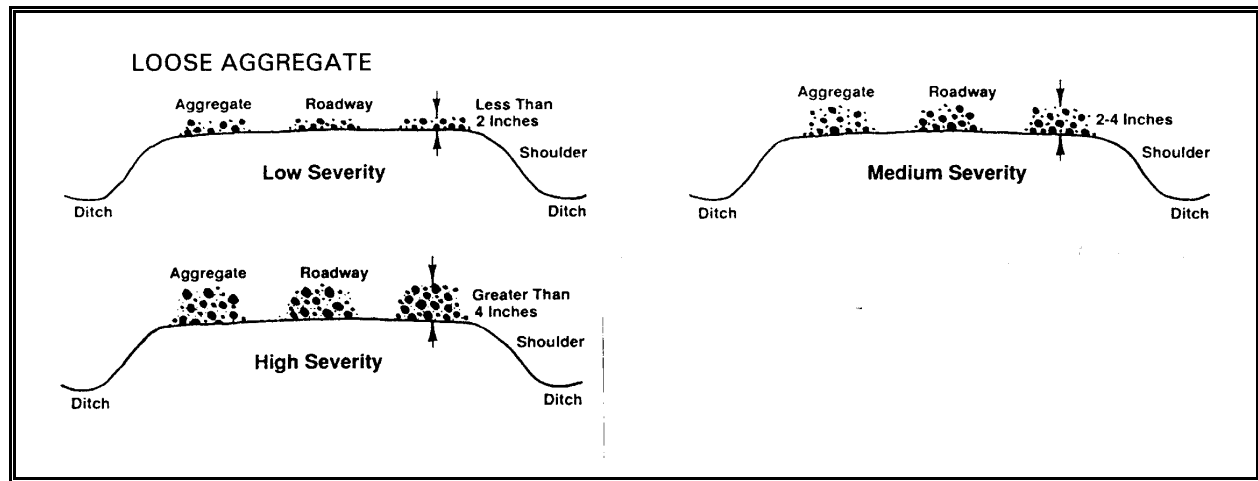
The wear and tear of traffic on unsurfaced roads will eventually loosen the larger aggregate particles from the soil binder. This leads to loose aggregate particles on the road surface or shoulder. Traffic moves loose aggregate particles away from the normal road wheel path and forms berms in the center or along the shoulder (the less traveled areas). Berms are a problem because they cause vehicles to swerve or "fishtail" as if on ice. They also prevent proper drainage from the road's surface.



Severity.

- | | | |
|-----------------|---|---|
| <u>Slight</u> | - | loose aggregate on the road surface, or a berm of aggregate (less than 2 inches deep) on the shoulder or less traveled area. |
| <u>Moderate</u> | - | moderate aggregate berm (between 2 and 4 inches deep) on the shoulder or less traveled area. A large amount of fine soil particles is usually found on the roadway surface. |
| <u>Severe</u> | - | large aggregate berm (greater than 4 inches deep) on the shoulder or less traveled areas. |

Extent. Loose aggregate usually forms in three berms as shown in the sketch. The extent is rated as the percentage of three berms of the total length of the inventory section. For example, three berms of loose aggregate for 25 ft. of the 100 ft. inventory section would be rated as a 25 percent extent. One berm extending the entire length of the section would be 33 percent, two berms, 50 percent and three berms, 100 percent.



STEP 8. Rate Riding Quality of Road

After the road surface inventory is completed, the road section is driven by the survey team in an "average" passenger car and the riding quality is ranked according to the following criteria:

- There are no problems in driving the speed limit.
- There is some roughness and bumpy ride when driving the speed limit.
- It is difficult to handle the vehicle when driving the speed limit. In some situations, the driver is forced to drive slower than the speed limit.
- It is impossible to drive the speed limit.

The appropriate rank number for the road section is entered on the Data Summary Form.

STEP 9. How to Score the Distress Types

When the condition survey is completed, the following information will be available for each road section:

- Data Summary Form (Form 1) - completed except for total distress points and the Road Condition Index.

- Inventory Data Forms (Forms 2 or 4) - two completed forms, one for each inventory station on each road section.

The following is an example of the steps required to calculate the total distress points and Road Condition Index for a typical section of paved road. The forms referred to are provided in this chapter.

- A. Forms 2A and 2B are examples of Inventory Data Forms that have been completed for each of the two inventory stations on the road section. The score for each of the 8 distress types is computed by using Form 3, the Scoring Key. For example, Inventory Station 1-1 (Form 2A) has an extent of 16-30 percent of rutting and a "moderate" severity rating. Next, compare this information with Form 3 that shows that "16-30 percent/moderate" rutting is awarded 4 points. This number (4) is then entered as the score under "rutting" on Form 2A. This procedure is then used to determine the point score for each of the 7 remaining distress types (i.e., "raveling - patching").
- B. Total the distress points in the left hand column of Form 2A (i.e., "rutting - patching, etc. ") and enter the total distress points in the space on the right hand top of Form 2A. The total distress points for inventory section 1-1 are 38. This same procedure is used to complete Form 2B for inventory section 1-2. Thus, section 1-2 has a distress point total of 41.
- C. The total distress points from each Inventory Data Form (Forms 2A and 2B) are entered on Form 1. The total distress points for each inventory station are added and divided by two to arrive at the Average Total Distress Points for the road section, $(38 + 41) / 2 = 39.5$ Average Total Distress Points.
- D. The Road Condition Index (RCI) is determined by subtracting the Average Total Distress points from 100. $100 - 39.5 = 60.5$ RCI. The lower the RCI number, the worse the condition of the road. The higher the number, the better the condition of the road.
- E. The work order category (type of repair recommended) is determined by the RCI point ranges shown on the bottom of Form 1. For example, a RCI of 60.5 falls into the 80 - 66 point range which calls for an overlay on paved roads. (If the road was not paved, a RCI of 60.5 would call for adding gravel to the road.)

The steps for computing the RCI and work order category for unsurfaced roads are the same as the foregoing procedure (that used a paved road as an example). The unsurfaced road forms are Forms 4 & 5.

STEP 10. Analyze Survey Results

A Preliminary Road Improvement Priorities Form (Form 6) is prepared which shows for each section: relative condition, Road Condition Index (RCI) ratings, work order category, cost estimates and other information. Cost estimates for routine maintenance

overlay or gravel and reconstruction should be computed from past projects, county maintenance records and estimates from local contractors.

The RCI ratings for all of the county's roads are listed in order from low to high. The lower the RCI rating, the worse the road condition. This results in a preliminary road improvement priority list.

STEP 11. Setting Street Improvement Priorities

At this point you may want to review the preliminary street improvement priority list (see Step 10). Make changes and adjustments as necessary based on practical considerations. The Road Condition Index (RCI) ratings indicate the relative degree of distress and deterioration for each street segment. The RCI ratings do not include such concerns as:

- The relative importance of the road segment with regard to the overall system. Major roads in the system should generally take priority over residential streets serving only a few houses.
- The amount of traffic a road is carrying.
- Infrastructure and utility improvements that should be completed before the road is improved.
- Road improvements needed to serve newly developing areas.

Consideration of the above factors may change the priority ranking of the various road segments.

When the maintenance supervisor has completed the road improvement priority list, the information is ready to be presented to the commissioners. Explain the data collection process and present the street improvement priority list for review and comments. The commissioners may suggest changes in the priorities based on other facility needs and the availability of funds.

Appendix E

Bridge System Planning

The need for safety inspections and maintenance of bridges became apparent to the nation when the 2,235 foot "Silver Bridge" at Point Pleasant, West Virginia, collapsed into the Ohio River on December 15, 1967. Forty-six people died. The U.S. Congress was asked to add a section to the "Federal Highway Act of 1968" requiring the Secretary of Transportation to establish a national bridge inspection standard, and a program to train bridge inspectors.

I. Bridges in Montana

Bridges are a vital component of the transportation system. However, we do not always think about how critical they are to Montana's communities. Every day, trucks, school buses, emergency vehicles and agricultural equipment, as well as automobiles, depend on the system of bridges across the state to bring them safely to their destination. In particular, some specialized vehicles, such as cement trucks which are used on a regular basis in the construction of residential homes, can easily exceed load limits on some culverts and bridges. Bridges that are in poor and failing condition, unable to hold heavy loads, provide serious obstacles to commerce, education and community health and safety.

To understand the true nature and condition of our bridges, we first need to understand what bridges are. We need to know how bridges are classified as part of the road system, who inspects them and how repairs, reconstruction and replacement are accomplished and funded.

There are over 5,200 bridges in Montana. Of these, 85 percent (4,433) receive regular inspections in accordance with federal guidelines. Nearly 25 percent of the inspected bridges are rated as "structurally deficient" or "functionally obsolete." This is slightly better than the national average of 30 percent deficient or obsolete. The percentage is higher, however, for local off-system bridges. There are 1,858 off-system bridges that are regularly inspected. Of these, 34 percent (632) need repair or replacement.

Counties often wait years for financial assistance because of the limited amount of local and state funds available each year. While counties delay funding to maintain, reconstruct or replace the most deficient bridges, the bridge inventory continues to age. We simply are not repairing or replacing our bridges at anywhere near the same rate at which they are deteriorating.

Counties can utilize the Montana Department of Transportation (MDT) bridge inspection data base for bridges under their jurisdiction and over twenty feet in length. For bridges under twenty feet, there is no consistent data base. Generally, counties rely on the information provided by road maintenance personnel, road supervisors, MDT and members of the public to determine the condition of roads and bridges. However, there needs to be more regular and consistent inspection of bridges under twenty feet in length, and local jurisdiction should include bridges into their capital facilities program.

II. The County's Role

County commissioners have jurisdictional responsibility for all of the off-system and many of the secondary bridges within their county, including those that are in incorporated areas. Counties should note that 7-14-2204, MCA gives them the authority to assess costs back to municipalities for construction or maintenance of bridges within cities or towns.

While MDT undertakes inspections of bridges that are at least twenty feet long, it is important for county officials to understand and interpret this inspection data in order to keep bridges in good repair. Inspection forms assist the county in determining which bridges require repair, reconstruction or replacement. For those bridges under twenty feet, the county alone is responsible for ensuring that regular inspections are conducted and for interpreting the information provided by a qualified inspector. Bridge inspection information assists county governments and residents in the overall process of road planning, as well as the county's capital improvement planning efforts. The information derived from the inspection process enables the county to determine the condition of bridges.

(Please note that those bridges prioritized through the secondary construction program, on and off-system bridge programs, Save Our Secondaries or Emergency Relief Programs, are funded entirely with federal and state funds. They are designed by, and construction is administered under, the authority of the Department of Transportation.)

III. Preparing a Bridge Plan

A. Introduction

The bridge planning process is one component of the road system planning process and the road planning process is a component of the capital facilities planning process. The same steps used in preparing a road system plan are used to develop a long-range plan for a bridge system. Figure D-1 in Appendix D illustrates the logical steps in the planning process.

B. Bridge System Map

At a minimum, a map must be prepared that shows the location of the bridges within the county that the county is responsible for maintaining. The road map discussed in Appendix D should be used as the base map for locating the bridges. The MDT has maps for each county that shows the road system and the bridges with spans of over twenty feet. All the bridges in the county should be added to the map. The map will be used for a variety of reasons by the jurisdiction. All the bridges should be located so that if a member of the public refers to an existing structure, it can be located and discussed. All structures that are under twenty feet in length and not inspected by the state should be located on the map. The only exceptions would be small culverts that are inspected and cleaned or repaired as part of general road maintenance. Computer based road maps containing bridge data will allow easy modification and the addition of

information as it becomes available. Bridges can also be categorized in many different ways.

C. Bridge Characteristics

Bridge characteristics are defined in terms of jurisdictional responsibility and the amount and type of use the bridge receives. The jurisdictional responsibility sets forth which government entity or combination of government entities are responsible for the different aspects of bridge inspection and maintenance. Bridges fit into a definite hierarchy of importance based upon the characteristics of usage and the volume of use.

1. Jurisdictional Responsibility

Most bridges fall under state or county jurisdiction. In some cases, bridges are privately owned or are under the jurisdiction of the Federal government. The jurisdiction having responsibility for the bridge or structure should be noted. In situations with multiple jurisdiction, the nature of the shared responsibilities should be noted. For example, the state has inspection responsibility for bridges over twenty feet in length, the local jurisdiction may have all other responsibility as a function of the classification of the bridge.

Montana's roads and bridges are divided into two general classifications that determine how they are funded and maintained.

- **On-System Bridges:** These include bridges that are part of the interstate and non-interstate national highways. They are located on designated primary and secondary highways. These bridges are inspected and maintained by the MDT. It is important to remember that there are 4,670 miles of secondary roads in Montana. The MDT maintains only 233 miles of secondary highway, the remaining 4,437 miles and their associated bridges are left for the counties to maintain.
- **Off-System Bridges:** All other bridges are classified as off-system and are both inside and outside incorporated areas. These bridges, if over twenty feet in length, are inspected by the MDT. The local jurisdiction (city or county) is responsible for inspection of bridges under twenty feet in length, including those bridges located in the 233 miles of MDT maintained secondary roads.

2. Classification of Bridges

Once jurisdictional responsibility is identified, the bridges are classified by amount and type of use. Bridges fit into a definite hierarchy based upon use. Bridges are part of the road system and can be classified in somewhat the same manner as the road on which they are located. When establishing the hierarchy of the bridges in the road system, it is important to consider the bridge type and usage. For example, a collector road accessed by farms, ranches and the National Forest may be used by local rural traffic, recreational traffic and logging truck traffic. The amount of use measured in Average Daily Traffic (ADT) may be low. The type of use is important for the bridges on this road, and they must be designed to handle the weight load associated with log truck traffic. The same classification of rural collector road that does not access the National Forest would have a different set of parameters for bridge design. This road may have to handle local traffic and grain trucks. In reviewing bridges, it is important to establish the bridge design characteristics based upon type of use and traffic volume.

3. Types of Bridge Construction

In discussing construction, it is useful to define just what we mean by a bridge. The technical definition is as follows:

A "bridge" is a structure including supports erected over a depression or an obstruction, such as water, highway or railway and having a track or passageway for carrying traffic or other moving loads and having an opening measured along the center of the roadway of more than twenty feet between underscopings of abutments or spring lines of arches, or extreme ends of openings for multiple boxes, it may also include multiple pipes, where the clear distance between openings is less than half of the smaller contiguous opening. [The National Bridge Inspection Standards published in the Code of Federal Regulations (23 CAR 650.3)].

In this appendix we will be less technical and refer to bridges of any length span so long as they are not culverts. A "bridge" (for our purposes) is any crossing that has a substructure and a superstructure. This means that a bridge has abutments and a deck.

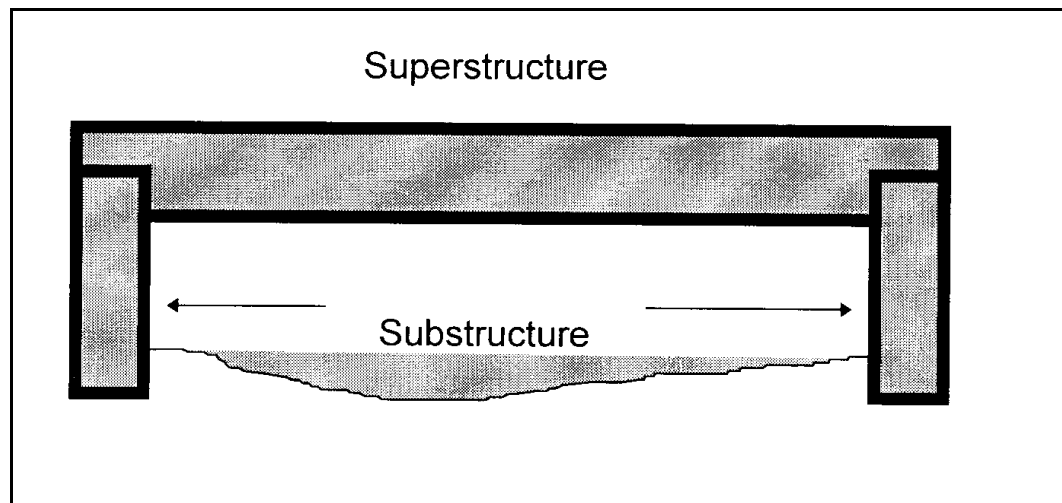
A "culvert" is a drainage opening beneath a road embankment. The opening is designed for full flow. A culvert has no definite distinction between substructure and it has no "deck." While culverts were once defined as bridges with a span of less than twenty feet, this definition is no longer used.

Types of bridges are classified based upon how the load is supported. There are three basic types of bridges:

- **Beam:** Loads on beam bridges are transmitted vertically to the supports. Gravity is the only force involved. Simple beams require their greatest bending strength at the center of the span. Some examples of beam bridges include:
 - Timber Stringer Bridges
 - Pre-stressed Concrete Boxes

- Steel Girders and Trusses
- **Arch:** Arches generally transmit their loads by pushing diagonally (rather than vertically) on their supports. Stone was the building material of early arches. Modern arches are made of steel or reinforced concrete.
- **Cable Supported:** Cable supported bridges are the reverse of the arch, in that cables generally transmit their loads by pulling on their supports.

**Figure E-1
Simple Beam Bridge**



The various types of bridges, their components and the different types of construction materials used in bridges are contained in the "Bridge Inspection Manual" available from the U.S. Department of Transportation.

4. Determining the Condition of Bridges

Bridge condition is determined by inspections. The MDT inspects all bridges with a span of twenty feet or greater. Counties have the responsibility to inspect all bridges under their jurisdiction that are less than twenty feet in length.

Counties also have the authority to complete their own inspections for bridges over twenty feet in length. For example, Missoula County inspects their own bridges with spans over twenty feet in length. The only county bridges the state inspects for Missoula County are those that require the use of the "Snooper" truck. A snooper truck is a specialized truck that is used to lower personnel over the side of a bridge to inspect the below deck components of the bridge.

Bridge condition analysis is based upon a proven system and adapted from the procedures contained in the "*Manual for Condition Evaluation of Bridges*" by the American Association of Highway and Transportation Officials, 1994, the "*Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges*" U.S. Department of Transportation, Federal Highway Administration, December 1995, the "*Bridge Inspection Manual*" Montana Department of Transportation Bridge Bureau, September 1990, and "*Bridge Inspectors Manual*" U.S. Department of Transportation, Federal Highway Administration, March 1995. However, there are a number of different systems in use. Trained personnel may have good reasons for recommending or using another system that may better suit the particular situation. Any jurisdiction or individual planning to conduct bridge inspections or use the information obtained from bridge inspections conducted by MDT, must obtain copies of the above-listed publications for reference manuals.

Bridge condition analysis should be undertaken (by qualified personnel) during the summer months when the bridge components such as the deck, piers and abutments are visible. Traditionally, bridge inspections have been completed during the winter when trained personnel are not working on construction jobs. It is possible that the water crossings may be full of ice, making below water inspections difficult. Decks may be saturated with water and frozen, thus, concealing important structural conditions and potential deterioration of the deck. Further, the decks may be covered with snow and ice that would prevent visual inspection of the deck surface.

It is also true that during the winter months, many crossings may be dry or the water low enough that visual inspection of the substructure units to the mud line is most easily accommodated at this time of year. For those instances when underwater inspections are required because the water is always present and substructure inspection is impossible, underwater inspections should be performed at a different time of year. Care should be taken to ensure that decks are not frozen and that the surface is free of ice and snow.

Helpful Definitions

National Bridge Inventory (NBI). The aggregation of structure inventory and appraisal data collected to fulfill the requirements of the National Bridge Inspection Standards that each state shall prepare and maintain an inventory of all bridges subject to the NBIS.

National Bridge Inventory (NBI) Record. Data that has been coded according to the guide for each structure carrying highway traffic or each inventory route that travels under a structure.

National Bridge Inspection Standards (NBIS). Federal regulations establishing

requirements for inspection procedures, frequency of inspections, qualifications of personnel, inspections reports and preparation and maintenance of a state bridge inventory. The NBIS apply to all structures defined as bridges located on all public roads.

Public Road. Any road under the jurisdiction of and maintained by a public authority and open to public travel.

Structure Inventory and Appraisal (SI&A) Sheet. The graphic representation of the data recorded and stored for each NBI record in accordance with this guide.

a. Qualifications of Inspection Personnel: The inspection of bridges involves important matters of public safety. Liability issues are also associated with the inspection of bridges. The "*Manual for Condition Evaluation of Bridges*" by the American Association of Highway and Transportation Officials, 1994, provides the following statement relative to the minimum qualification requirements for bridge inspection personnel:

The individual in charge of the organization unit that has been delegated the responsibilities for bridge inspection, reporting and inventory shall possess the following minimum qualifications:

1. Registered Professional Engineer; or,
2. Qualified for registration as a professional engineer under the laws of the state; or,
3. Ten years (minimum) experience in bridge inspection assignments in a responsible capacity and completion of a comprehensive training course based on the "*Bridge Inspector's Manual*" developed by a joint federal-state task force, published by the U.S. Department of Transportation.

The "*Bridge Inspector's Manual*" may be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

The Bridge Inspector is responsible for the thoroughness of field inspection, analyses of all findings ascertained by the inspection and the subsequent recommendations for correction of defects, posting for restricted load and/or speed or any other recommendations deemed necessary. The problems encountered in this work are numerous, variable, and often complex. Consequently, the inspector's judgment is required frequently for proper evaluation of the findings.

The inspector must be thoroughly familiar with design and construction features of the bridge to properly interpret what is observed and reported. The inspector must be capable of determining the safe load carrying capacity of the structure. The inspector must be able to recognize any structural deficiency, assess its seriousness and take

appropriate action necessary to keep the bridge in a safe condition. The inspector must also recognize areas of the bridge where a problem is incipient so that preventive maintenance can be properly programmed.

Seldom will one individual have experience sufficient to qualify as an expert in all of the specialized fields of engineering that are a part of bridge science. The individual should be aware of any limitations imposed by lack of experience in any area of the work. This individual should never hesitate to utilize the specialized knowledge and skills of associate engineers in the fields of structural design, construction, materials, maintenance, electrical equipment, machinery, hydrodynamics, soils or emergency repairs. Consideration should be given to obtaining assistance from other engineers where regular staff is not available or where assistance is required on specialized structures such as suspension bridges, movable bridges or unusually large structures.

A bridge inspection team operating as a part of the organizational unit must be headed by an individual with the following minimum qualifications:

1. Have the qualifications as listed for the organizational unit head; or,
2. Five years (minimum) experience in bridge inspection assignments in a responsible capacity and completion of a comprehensive training course based on the "*Bridge Inspector's Manual*" developed by a joint federal-state task force, published by the U.S. Department of Transportation. Information on this training course may be obtained from the MDT and the Federal Highway Administration.

b. Responsibilities of the Bridge Inspector: As the state's bridges age and deteriorate, accurate and thorough assessments of each bridge's condition is vital to maintaining our road and highway system. The bridge inspector has specific responsibilities. There are a number of things the inspector can do to prepare for the execution of these responsibilities safely.

There are five basic responsibilities of the bridge inspector:

- Maintain public safety and confidence
- Protect the public investment
- Provide bridge inspection program support
- Provide accurate bridge records
- Fulfill legal responsibilities

The first responsibility is to maintain public safety and confidence. If a bridge fails, the public confidence in the bridge system is compromised. The inspector's role is:

- Provide thorough inspections identifying bridge conditions and defects.
- Prepare condition reports documenting these deficiencies and presenting recommendations.

c. *Frequency of Inspection:* Bridges deteriorate with time. Unusual incidents occur that can jeopardize the integrity of a bridge. For these and other reasons, bridge inspections must occur at regular intervals. The "*Manual for Condition Evaluation of Bridges*" by the American Association of Highway and Transportation Officials, 1994, provides the following statement relative to the frequency of inspection requirements for bridges:

Each bridge should be inspected at regular intervals not to exceed two years by personnel having the necessary qualifications as previously stated. The depth and frequency to which bridges are to be inspected will depend on such factors as age, traffic characteristics, state of maintenance and known deficiencies. The evaluation of these factors will be the responsibility of the individual in charge of the inspection program. Some items such as boring timber, checking submerged portions of submarine cables, etc., require less frequent inspections as noted in 2.4 Inspection Procedures and Reports.

Interim inspections are required for any bridge with known deficiencies or that is in questionable condition. All bridges that are posted for a weight limit less than that which is legal on the highways in the state will also require interim inspections.

At the discretion of the engineer, some of these interim inspections may be delegated to highway maintenance personnel who have been instructed specifically in their inspection assignments, methods of reporting their findings and procedures to be followed in the event of a bridge emergency situation. This may be accomplished through the Superintendent or Supervisor responsible for general maintenance of the highway in the area of the bridge requiring interim inspection.

So far as is practicable, the engineer should schedule bridge inspections in those periods of the year that offer the most desirable conditions for thorough inspections. Substructures of bridges over streams or rivers can best be inspected at times of low water, and structures requiring high climbing should be inspected during those seasons when high winds or extremes of temperature are not prevalent. Inspections during temperature extremes should be made at bearings, joints, etc., where trouble from thermal movement is suspected. These are only a few examples to illustrate the importance of proper scheduling.

Inspections should not be confined to searching for defects that may exist, but should include the range of anticipating problems and recognizing these areas. This category is classified as preventive maintenance inspections as opposed to corrective maintenance inspections.

d. *Bridge Inspection Reports:* The purpose of the bridge inspection reporting system is to have trained and experienced personnel record objective and subjective observations of all elements of a bridge and to make logical deductions and conclusions from their observations. The bridge inspection report represents a systematic inventory of the current condition of all bridge members and possible future

weaknesses. The bridge report form is the basis of quantifying the personnel, equipment, materials and funds necessary to maintain the integrity of the structure.

Narrative descriptions of the conditions must be clearly presented in the same order as the inspection sequence. All signs of distress, failure or defects should be noted with sufficient accuracy that another inspector at a future date may make a comparison of condition or rate of disintegration.

The inspection report must explain in detail the type and extent of any deterioration found on the bridge and point out any deviations or modifications that are contrary to the "As-Built" construction plans. Not all conditions of deterioration are of equal importance.

The inspector, in formulating conclusions, should report the seriousness of the defect or deficiency involved. The inspector's experience and judgment are called upon when interpreting inspection results and arriving at reasonable and practical conclusions. The conclusions are the heart of the inspection report. Improper and misinformed conclusions will lead to improper recommendations. The inspector will play the role of a detective to conclude why, how or when certain defects occurred. When the inspector cannot interpret the inspection findings, the advice of more experienced personnel should be sought.

The recommendations made by the inspector constitute the "focal point" of the operation of inspecting, recording and reporting. A thoroughly documented inspection is essential for making informed and practical recommendations to correct or preclude bridge defects or deficiencies.

All instructions for maintenance work, stress analysis, postings, further inspection and repair must be included. The inspector must carefully consider the benefits to be derived from making repairs and the consequences, if the recommended repairs are not completed. The inspector should list, in order of greatest urgency, any repairs that are necessary to maintain structural integrity and public safety.

Recommendations concerning repairs may be classified into two general categories:

- Urgent Repairs
- Programmed Repairs

The inspector will decide whether a repair is "urgent." Usually, this is easily determined but occasionally, the experience and judgment of a professional engineer may be required to reach a proper decision regarding the urgency of the need for repair. Most recommendations concerning repairs submitted by the bridge inspector will be in the category of "Programmed Repairs." Whenever recommendations call for bridge repairs, the inspector should carefully describe the type of repairs that are needed, scope of work to be done and an estimate of the quantity of materials that will be required.

The inspection report as previously mentioned enables bridge maintenance to be programmed more effectively through early detection of structural defects or deficiencies, thus minimizing repair costs. If an inspection report describes defects or deficiencies that may affect the load capacity of the structure, a revised stress analysis must be performed. The stress analysis is made to determine the safe load capacity for the current conditions. It may be necessary to restrict loads crossing the bridge so that the safe load capacity is not exceeded. It is important that the calculations for the revised load-carrying capacity analysis become part of the structural file.

A good bridge inspection reporting system is essential in order to protect the lives of the public and also to protect the public's investment in bridges. It is essential that bridge inspection reports be clear and complete. The reports should become an integral part of the lifelong record of each bridge. A thorough review by the person responsible for the successful operation of each bridge is just as important as the detailed inspection. A good inspection is of no value if the report data is not reviewed or used to make operational decisions. In addition, it is important to retain inspection records over the long term in order to help identify changes to the condition of bridges over time.

Due to the requirements that must be fulfilled for the National Bridge Inspection Standards (NBIS) it is necessary to employ a uniform bridge inspection reporting system. A uniform reporting system is essential to correctly and efficiently evaluate the condition of a structure. As previously stated, a reporting system is a valuable aid in establishing maintenance and replacement priorities, and determining structure capacity and the cost of maintaining the bridges. The information necessary to make these determinations must come largely from the bridge inspection reporting system. The importance of the reporting system and its review cannot be overemphasized.

The Structure Inventory and Appraisal (SI&A) sheet is a tabulation of pertinent information about an individual structure. It is important to note that the SI&A sheet is not an inspection form, but a summary sheet of bridge data required by the FHWA to effectively monitor and manage the National Bridge Inspection Program and the Highway Bridge Rehabilitation and Replacement Program. (Refer to the back of this Appendix for sample SI&A and Supplemental SI&A forms used by MDT.)

1. Inventory Items - Bridge Characteristics

- **Identification** - identifies the structure using location codes and descriptions.
- **Classification** - classification of the structure and the facilities carried by the structure are identified.
- **Age and service** - information showing when the structure was constructed or reconstructed, features the structure carries and crosses, and traffic information.
- **Structure type and material** - categorizes the structure based on the material, design and construction, the number of spans, and wearing surface.
- **Geometric data** - pertinent structural dimensions.
- **Navigation data** - identifies the existence of navigation control, pier protection and waterway clearance measurements.

- **Load rating and posting** - identifies the load capacity of the bridge and the current posting status.
- **Proposed improvements** - items proposed for improvements and estimated costs for all bridges eligible for funding.
- **Inspection** - inspection dates, frequency and special emphasis.

All inventory items are explained in the "Coding Guide." Although inventory items are usually provided from previous reports, the inspector must be able to verify and update the inventory data should it be required.

2. Condition Rating Items

The condition of an element, member or component is an evaluation of its current physical state compared to the "As-Built" (New) Condition.

The inspector will evaluate each element of a given component and assign to it a descriptive condition rating of "Good," "Fair" or "Poor" based on the deficiencies noted on the individual element. Here are the "Condition Rating Guidelines":

- Good** - Element is limited to only to minor problems.
- Fair** - Structural capacity of element is not affected by minor deterioration, section loss, spalling, cracking or other deficiency.
- Poor** - Structural capacity of element is affected or jeopardized by advanced deterioration, section loss, spalling, cracking, or other deficiency.

To ensure a comprehensive inspection and as a part of the requirements of record keeping and documentation, an inspector will record the type, size, quantity, and severity of deterioration and deficiencies for each element in a given component.

The following SI&A items receive an overall condition rating:

- Items No. 58 Deck
- Items No. 59 Superstructure
- Items No. 60 Substructure
- Items No. 61 Channel and Channel Protection
- Items No. 62 Culverts

Items 58 through 60 are considered major components of a bridge and they are not included with Item 62. Item 61 is used only for structures over waterways.

The numerical condition ratings should characterize the general condition of the entire component being rated. They should not attempt to describe localized or nominally occurring instances of deterioration or disrepair. Correct assignment of a condition rating must, therefore, consider both the severity of the deterioration or disrepair and the extent to which it is widespread throughout the component being rated.

However, in some cases, a deficiency will occur on a single element or in a single location. If that one deficiency reduces the load carrying capacity or serviceability of the component, then the element can be considered a "weak link" in the structure, and the rating of the component should be reduced accordingly.

The following general condition rating guidelines (obtained from the 1988 version of the Coding Guide) will be used in the evaluation of the deck, superstructure and substructure.

<u>Code</u>	<u>Description</u>
N	NOT APPLICABLE
9	EXCELLENT CONDITION
8	VERY GOOD CONDITION - No problems noted.
7	GOOD CONDITION - Some minor problems.
6	SATISFACTORY CONDITION - Structural elements show some minor deterioration.
5	FAIR CONDITION - All primary structural elements are sound but may have some section loss, cracking, spalling or scour.
4	POOR CONDITION - Advanced section loss, deterioration, spalling or scour.
3	SERIOUS CONDITION - Loss of section, deterioration, spalling or scour have seriously affected primary structural components. Local failures are possible. Fatigue cracks in steel or shear cracks in concrete may be present.
2	CRITICAL CONDITION - Advanced deterioration of primary structural elements. Fatigue cracks in steel or shear cracks in concrete may be present or scour may have removed substructure support. Unless closely monitored it may be necessary to close the bridge until corrective action is taken.

<u>Code</u>	<u>Description</u>
1	"IMMINENT" FAILURE CONDITION - Major deterioration or section loss present in critical structural components or obvious vertical or horizontal movement affecting structural stability. Bridge is closed to traffic but corrective action may put bridge in light service.
0	FAILED CONDITION - Out of service; beyond corrective action.

The condition rating of a bridge is a reflection of the bridge's structural capacity, not its load-carrying capacity. The load-carrying capacity is reflected in the Structural Evaluation appraisal rating.

A bridge's load-carrying capacity is not to be used in condition rating process. The fact that a bridge was designed for less than current legal loads, and may even be posted, should have no influence upon the condition rating.

Structural capacity is defined as the designed strength of the member. However, structural capacity is different from load-carrying capacity. Load carrying capacity refers to the ability of the member to carry the legal loads of the highway system of which a bridge is a part. Therefore, a bridge could possibly have good structural capacity yet be load posted because it is unable to carry the legal loads. Such bridges are determined to be "functionally obsolete" but not "structurally deficient." However, if the bridge has been given a "sufficiency rating" of less than 80 by MDT, it will qualify for federal funding under the Federal Highway Bridge Replacement and Rehabilitation Program whether it is functionally obsolete *or* structurally deficient.

3. Appraisal Rating Items

The following SI&A items are known as appraisal rating items:

- Item No. 67 Structural Evaluation
- Item No. 68 Deck Geometry
- Item No. 69 Underclearances, Vertical and Horizontal
- Item No. 71 Waterway Adequacy
- Item No. 72 Approach Roadway Alignment

Appraisal rating items are used to evaluate a bridge in relation to the level of service that it provides on the highway system of which it is a part. The structure should be compared to a new one that is built to current standards for that particular type of road. The exception is Item 72, Approach Roadway Alignment. Rather than comparing the alignment to current standards, it is compared to the general existing alignment of the approach highway.

The level of service goals used to appraise bridge adequacy vary depending on the highway functional classification, traffic volume, and other factors. The goals are set

with the recognition that widely varying traffic needs exist throughout highway systems. Many bridges on local roads can adequately serve traffic needs with lower load capacity and geometric standards than would be necessary for bridges on heavily traveled main highways.

If national uniformity and consistency are to be achieved, similar structure, roadway, and vehicle characteristics must be evaluated using identical standards. Therefore, tables and charts have been developed that must be used to evaluate the appraisal rating items for all bridges submitted to the National Bridge Inventory, regardless of individual state criteria used to evaluate bridges.

The tables appear in the *Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges* (pages 42, 43, 45,47).

D. Determine Corrective Action

The methods previously described pertaining to bridges should also be used by counties to maintain their bridges that are less than twenty feet in length. The proper use of the bridge inspection reports will let the administrators set schedules and budget dollars for the required replacement of the deficient element.

For example many county bridges in Montana have timber decks. As these decks deteriorate, their ratings will continue to be downgraded. When the bridge receives a rating of 5 or 6, the county should start setting aside funds or putting that bridge into a priority sequence for a new deck, knowing that in several more years the deck will have a rating of 2 or 3. Thus, by using the condition ratings in the inspection reports, a schedule for bridge replacements or rehabilitations can be established.

The decision to rehabilitate or replace will involve many parameters. For example, it would not make sense to put a new timber deck on timber bridge stringers that are decayed. On the other hand, it would not make sense to replace a concrete bridge that had a few deck delaminations but otherwise is sound.

The decision making process should begin with a review of the respective "Bridge Sufficiency Rating." A value greater than 50 will indicate rehabilitation as the desired repair method. There will be additional factors to consider along with the empirical formula method. If there is a question as to whether to replace or rehabilitate and the answer does not become obvious, then consult a professional engineer to aid in the evaluation process.

Once the condition of each bridge within the jurisdiction has been determined, appropriate corrective action can be investigated for each deficiency. Corrective action falls into two general categories, "replacements in kind" and "rehabilitation". As discussed in the previous section, the "Bridge Sufficiency Rating" will provide a strong indication of whether replacement or rehabilitation is necessary.

- **Replacements in kind** refer to replacing damaged or worn bridge components with identical components. The construction process can be complex or relatively simple

as a function of the component being replaced or repaired. Replacements in kind generally do not need the services of a structural engineer. However, replacements in kind *do require* construction skills necessary to safely and effectively perform the required work.

- **Rehabilitation** refers to corrective action that requires the skills of a structural engineer. Rehabilitation requires construction or reconstruction involving significant design or redesign such that a structural engineer must be involved in the rehabilitation from design through construction inspection.

The identification of alternatives available for corrective action should not be limited to traditional methods. One example of innovative solutions is the application of "low water" crossings in Teton County. Faced with expensive bridge replacement costs on non-essential routes, the county decided to install low water crossings on the Teton River and on Badger Creek.

Low water crossings consist of a series of culverts that are placed in the stream parallel to the flow. These culverts are sized to handle normal stream flows. The culverts are covered with compacted earth and gravel. The earthen cover is then capped on the top, upstream and downstream sides with concrete. This concrete cap forms a driving surface. Normal water flows are contained in the culverts and high water flows over the structure.

The crossings are designed to be utilized during low water periods. During high water, the structures are inundated and not usable. The installation of low water crossings reduces travel times for local residents, reduces travel times during the harvest period, provides alternative routes to rural locations and costs far less than traditional bridges to install.

However, while innovation can result in cost savings, proper design is essential. The public's safety demands it and the responsible expenditure of public funds demands it. In the example for Teton County, the low water crossings could have been better designed. Crossings such as these can experience both upstream and downstream erosion that undermines structures. Installation of energy dissipation structures and proper elevations on culvert inverts can help prevent damage.

E. Cost Analysis

The next step is to assign cost estimates to the corrective action or new facilities required. If the action consists of normal maintenance the costs should be able to be estimated by road department staff. If the action involves replacements in kind, costs can be obtained by requesting estimates from local construction firms or by individuals trained in cost estimating. Cost estimates for rehabilitation can be obtained from the structural engineer working with the local jurisdiction on the project.

F. Establishing The Relative Importance of Bridges

The final use of the inspection report is analysis of the SI&A data by MDT and the Federal Highway Administration. The intent of the analysis is to aid in the decisions for

allocating and prioritizing resources. The eligibility for federal funding is determined by a bridge's "Sufficiency Rating."

The "Sufficiency Rating" uses a scale of 0 to 100. Deficient bridges receive low sufficiency ratings. Bridges that score below 80 are eligible for rehabilitation funds and bridges scoring below 50 are eligible for replacement funds.

Deficient bridges are divided into two categories:

- 1. Structurally Deficient.** Weight is restricted due to condition, in need of rehabilitation or is closed.
- 2. Functionally Obsolete.** May be structurally sound but does not meet current standards due to inadequacies in deck geometry, clearances or approach roadway alignment.

The calculation of a "Bridge Sufficiency Rating" is based on an empirical formula that assigns points on the basis of approximately 19 separate SI&A items, with up to 55 points determined by structural adequacy and safety. Up to 30 points are for serviceability and functional obsolescence. This includes items such as deck condition, structural evaluation, deck geometry, underclearances, waterway adequacy, and approach roadway alignment. Up to 15 points are for items such as detour length, average daily traffic (ADT), and defense highway designators. Finally, up to 13 points are for items such as traffic safety features, and structural type.

G. Public Participation and Establishing Priorities

Once the relative condition of bridges is determined, the public must be included in the process of identifying priorities for funding, repair, replacement or new construction. The public participation process described in *Chapter 2, Measuring Need and Setting Priorities*, is used to identify the bridge system priorities along with the road system priorities. Public participation is important to the extent that it helps gather more objective information on the bridges and how they relate to community needs. Setting priorities should be based on objective information and not on the "squeaky wheel" principal or "applause meter" approach.

IV. Labor and Equipment Concerns

Bridges range from the simple to the complex. Personnel qualifications to assess the condition of bridges, determine corrective action and implement the specified action range from road crew personnel to highly specialized structural engineers. The equipment needed to assess condition and implement repairs can also range from simple to highly specialized. The county can obtain help and advice from the MDT in determining the personnel and equipment needs of each specific situation.

In the final analysis, certain aspects of the bridge system planning process are highly technical and require trained personnel and special equipment. This chapter is not

intended as a trainer for those who wish to engage in bridge system planning. Rather, it is a collection of information and a presentation of the bridge planning process. It is intended to provide an understanding of the process so that counties can better utilize available resources and outside resources to obtain maximum benefit for their constituents.

Forms

Structural Inventory and Appraisal
SI&A. Supplemental Form
Forest Service Inspection Forms